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SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM
BULLETIN 203

LIFE HISTORIES OF NORTH AMERICAN WOOD WARBLERS

ORDER PASSERIFORMES

BY

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The series of *Bulletins*, the first of which was issued in 1875, contains separate publications comprising monographs of large zoological groups and other general systematic treatises (occasionally in several volumes), faunal works, reports of expeditions, catalogs of type specimens, special collections, and other material of similar nature. The majority of the volumes are octavo in size, but a quarto size has been adopted in a few instances in which the larger page was regarded as indispensable. In the *Bulletin* series appear volumes under the heading *Contributions from the United States National Herbarium*, in octavo form, published by the National Museum since 1902, which contain papers relating to the botanical collections of the Museum.

The present work forms No. 203 of the *Bulletin* series.

Remington Kellogg,
Director, United States National Museum.

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INTRODUCTION

This is the nineteenth in a series of bulletins of the United States National Museum on the life histories of North American birds. Previous numbers have been issued as follows:

107. Life Histories of North American Diving Birds, August 1, 1919.
113. Life Histories of North American Gulls and Terns, August 27, 1921.
121. Life Histories of North American Petrels and Pelicans and Their Allies, October 19, 1922.
126. Life Histories of North American Wild Fowl (part), May 25, 1923.
130. Life Histories of North American Wild Fowl (part), June 27, 1925.
135. Life Histories of North American Marsh Birds, March 11, 1927.
142. Life Histories of North American Shore Birds (pt. 1), December 31, 1927.
146. Life Histories of North American Shore Birds (pt. 2), March 24, 1929.
162. Life Histories of North American Gallinaceous Birds, May 25, 1932.
167. Life Histories of North American Birds of Prey (pt. 1), May 3, 1937.
170. Life Histories of North American Birds of Prey (pt. 2), August 8, 1938.
174. Life Histories of North American Woodpeckers, May 23, 1939.
176. Life Histories of North American Cuckoos, Goatsuckers, Hummingbirds, and Their Allies, July 20, 1940.
179. Life Histories of North American Flycatchers, Larks, Swallows, and Their Allies, May 8, 1942.
191. Life Histories of North American Jays, Crows, and Titmice, January 27, 1947.
195. Life Histories of North American Nuthatches, Wrens, Thrashers, and Their Allies, July 7, 1948.
196. Life Histories of North American Thrushes, Kinglets, and Their Allies, June 28, 1949.
197. Life Histories of North American Wagtails, Shrikes, Vireos, and Their Allies, June 21, 1950.

The paragraphs on distribution for the Colima and Kirtland's warblers were supplied by Dr. Josselyn Van Tyne with his contributions on these species.

All other data on distribution and migration were contributed by the Fish and Wildlife Service under the supervision of Frederick C. Lincoln.

The same general plan has been followed as explained in previous bulletins, and the same sources of information have been used. It does not seem necessary to explain the plan again here. The nomenclature of the Check-List of North American Birds (1931), with its supplements, of the American Ornithologists' Union, has been followed. Forms not recognized in this list have not been included.

Many who have contributed material for previous Bulletins have continued to cooperate. Receipts of material from several hundred contributors has been acknowledged in previous Bulletins. In addition to these, our thanks are due to the following new contributors: G. A. Ammann, O. L. Austin, Jr., F. S. Barkalow, Jr., Ralph Beebe, H. E. Bennett, A. J. Berger, Virgilio Biaggi, Jr., C. H. Blake, Don Bleitz, B. J. Blincoe, L. C. Brecher, Jeanne Broley, Maurice Broun, J. H. Buckalew, I. W. Burr, N. K. Carpenter, May T. Cooke, H. L. Crockett, Grace Crowe, Ruby Curry, J. V. Dennis, E. von S. Dingle, M. S. Dunlap, J. J. Elliott, A. H. Fast, Edith K. Frey, J. E. Galley, J. H. Gerard, Lydia Getell, H. B. Goldstein, Alan Gordon, L. I. Grinnell, Horace Groskin, F. G. Gross, G. W. Gullion, E. M. Hall, R. H. Hansman, Katharine C. Harding, H. H. Harrison, J. W. Hopkins, N. L. Huff, Verna R. Johnston, Malcolm Jollie, R. S. Judd, M. B. Land, Louise de K. Lawrence, R. E. Lawrence, G. H. Lowery, J. M. Markle, C. R. Mason, D. L. McKinley, R. J. Middleton, Lyle Miller, A. H. Morgan, R. H. Myers, W. H. Nicholson, F. H. Orcutt, H. L. Orians, R. A. O'Reilly, A. A. Outram, G. H. Parks, K. C. Parkes, M. M. Peet, J. L. Peters, F. A. Pitelka, Mariana Roach, James Rooney, Jr., O. M. Root, G. B. Saunders, James Sawders, Mary C. Shaub, Dorothy E. Snyder, Doris Heustis Speirs, E. A. Stoner, P. B. Street, H. R. Sweet, E. W. Teale, A. B. Williams, G. G. Williams, R. B. Williams, Mrs. T. E. Winford, and A. M. Woodbury.

As the demand for these Bulletins is much greater than the supply, the names of those who have not contributed to the work during recent years will be dropped from the author's mailing list.

Dr. Winsor M. Tyler has again read and indexed for this volume a large part of the current literature on North American birds and has contributed four complete life histories. Dr. Alfred O. Gross has written stories on the yellowthroats (*Geothlypis trichas*) and has contributed three other complete life histories. Edward von S. Dingle, Alexander Sprunt, Jr., and Dr. Josselyn Van Tyne have contributed two complete life histories each.

William George F. Harris has increased his valuable contribution to the work by producing the entire paragraphs on eggs, including descriptions of the eggs in their exact colors, assembling and averaging the measurements, and collecting and arranging the egg dates, as they appear under Distribution; the preparation of this last item alone required the handling of over 5,600 records.

Clarence F. Smith has furnished references to food habits of all the species of wood warblers. Aretas A. Saunders has contributed full and accurate descriptions of the songs and call notes of all the species with which he is familiar, based on his extensive musical records. Dr. Alexander F. Skutch has sent us full accounts of all the North American wood warblers that migrate through or spend the winter in Central America, with dates of arrival and departure. James Lee Peters has furnished descriptions of molts and plumages of several species and has copied several original descriptions of subspecies from publications that were not available to the author.

Eggs were measured for this volume by American Museum of Natural History (C. K. Nichols), California Academy of Sciences (R. T. Orr), Colorado Museum of Natural History (F. G. Brandenburg), C. E. Doe, W. E. Griffee, W. C. Hanna, E. N. Harrison, H. L. Heaton, A. D. Henderson, Museum of Comparative Zoology (W. G. F. Harris), and Museum of Vertebrate Zoology (M. Jollie).

The manuscript for this Bulletin was written in 1945; only important information could be added. If the reader fails to find in these pages anything that he knows about the birds, he can only blame himself for failing to send the information to—

THE AUTHOR.

LIFE HISTORIES OF NORTH AMERICAN WOOD WARBLERS

Order PASSERIFORMES: Family PARULIDAE

By ARTHUR CLEVELAND BENT
Taunton, Mass.

GENERAL REMARKS ON THE FAMILY PARULIDAE

CONTRIBUTED BY WINSOR MARRETT TYLER

The family of wood warblers, Parulidae, is the second largest family of North American birds, surpassed only in number of species by the family Fringillidae. The wood warblers occur only in the Western Hemisphere; they are distinct from the Old World warblers, Sylviidae, although the two families play a similar rôle in nature's economy.

The wood warblers are largely nocturnal migrants, whose long journeys in the dark of night over sea and lake and along the coast expose them to many perils, one being the lighthouses they strike with frequently fatal results. Their notes are seldom heard from the night sky during their spring migration, but on many a calm, quiet night in August and September, as they fly overhead, their sharp, sibilant, staccato notes punctuate the rhythmic beat of the tree-crickets singing in the shrubbery and stand out clearly among the soft, whistled calls of the migrating thrushes.

The length of migration varies greatly; the pine warbler withdraws in winter only a short distance from the southern limit of its breeding range, whereas the most northerly breeding blackpolls migrate from Alaska to the Tropics. In spring many species migrate at nearly the same time, apparently advancing northward in intermittent waves of great numbers during favorable nights. Flocks made up of sometimes a dozen species together flash about in their bright plumage during the week or two at the height of the migration and furnish days of great excitement to ornithologists. Their return in late summer and autumn is more leisurely and regular; in loose flocks they drift slowly by for several weeks, their southward passage evident even in daytime. The flocking begins early, soon after nesting is over, and to the north is apparent early in July, if closely watched for, even before the leaves begin to wither. The mixed fall flocks, with adults in winter plumage and young birds in duller colors, present many fascinating problems in identification as the birds move quietly along.

[AUTHOR'S NOTES: When I asked Dr. Tyler to contribute these remarks we discussed Professor Cooke's (1904) theory of trans-Gulf migration, which has been generally accepted until recently, when it was challenged by George C. Williams (1945). This paper started a discussion in which George H. Lowery, Jr. (1945), has taken a prominent part, and of which we have not yet heard the last. Routes of migration from South America to the United States are evidently well established through the West Indies and the Bahamas to the southeastern States; across the Caribbean to Jamaica, Cuba, and Florida; through Central America and directly across the Gulf from Yucután to the Gulf States; through eastern Mexico and Texas; and through western Mexico to the southwestern States. Professor Cooke was probably correct in assuming that the majority of wood warblers breeding in eastern North America migrate directly across the Caribbean or the Gulf. Some species may confine themselves to only one of the routes named, but we need more data to say just which species uses what route.]

The literature contains descriptions of several warblers not recognized as established species by the A.O.U. Check-List (1931). Some, described and illustrated by older writers such as Wilson and Audubon, cannot be identified; others are presumably hybrids; and one, *Sylvia autumnalis* Wilson, the autumn warbler, is clearly the blackpoll in fall plumage. The first category includes *Dendroica carbonata* (Audubon), the carbonated warbler, of which the Check-List says "the published plates may have been based to some extent on memory"; *D. montana* (Wilson), the blue mountain warbler, which is "known only from the plates of Audubon and Wilson"; and *Wilsonia* (?) *microcephala* (Ridgway), the small-headed flycatcher, of which it says: "Known only from the works of Wilson and Audubon whose specimens came from New Jersey and Kentucky respectively. There is some question whether they represent the same species."

In the second category is *Vermivora cincinnatiensis* (Langdon), the Cincinnati warbler, described in 1880. "The unique type is regarded as a hybrid between *Vermivora pinus* (Linnaeus) and *Oporornis formosa* (Wilson)." Recently, in a letter dated August 3, 1948, Dr. George M. Sutton reports to Mr. Bent the discovery of a second Cincinnati warbler, taken in Michigan on May 28, 1948. He says: "Its bill and feet are large for *Vermivora* and its under tail coverts proportionately too long for that genus. It has only a faint suggestion of wing-barring and the merest shadow of a pattern on the outer rectrices. One of its most interesting and beautiful characters is the gray tipping of the feathers at the rear of the crown, as in *O. formosus.* The effect is very unusual, for the gray-tipped feathers are yellow. It is, in short, obviously a cross between *Vermivora* and *Oporornis.*"

The status of *Vermivora leucobronchialis* and *V. lawrencii* and the relationship between them puzzled ornithologists for upward of two generations. William Brewster (1876) described the former as a new species, and since that time, as Walter Faxon (1911) writes, "almost every conceivable hypothesis has been advanced by one writer or another to fix its true status in our bird-fauna." In addition to being considered a valid species, it has been regarded as a hybrid (Brewster, 1881), as a dichromatic phase, that is, a leucochroic phase of *V. pinus* (Ridgway, 1887), as a mutant (Scott, 1905), and finally as a phase, "ancestral in character" (atavistic) of the goldenwing (C. W. Townsend, 1908).

Lawrence's warbler is a very rare bird. The first specimen was described in 1874 (Herold Herrick, 1874), and since that time the bird was taken or seen infrequently, chiefly in regions where the breeding ranges of *V. chrysoptera* and *V. pinus* overlap. Consensus of opinion in the main regarded it as a hybrid between *V. chrysoptera* and *V. pinus*, as it combined characters of both the supposed parents. John Treadwell Nichols (1908) some years ago brought new light to the problem. He says:

> In any discussion of the status of Lawrence's and Brewster's Warblers it is well to bear in mind the facts, including the much greater abundance of Brewster's, are in accord with Mendel's Law of Heredity, supposing both forms to be hybrids between *Helminthophila pinus* and *H. chrysoptera*. * * * All the first generation hybrids will be Brewster's Warbler in plumage. In the next generation there will be pure Golden-winged Warblers, pure Blue-winged Warblers, pure Brewster's Warblers, and pure Lawrence's Warblers; also mixed birds of the first three forms, but none of the last form, which, being recessive, comes to light only when pure. The original hybrids then (which will be all Brewster's in plumage) must be fertile with one another or with the parent species for any Lawrence's to occur; and if they are perfectly fertile Lawrence's must still remain a small minority. After the first generation the proportion of plumages of birds with mixed parentage should be: 9 Brewster's, 3 *chrysoptera*, 3 *pinus*, 1 Lawrence's.

This explanation removed the stumbling block, long believed to be insurmountable, that a black-throated bird, mating with a yellow-throated bird, could produce progeny having a white throat. Under Mendel's Law the dominant color (white) of *chrysoptera* would appear by the suppression of the recessive black throat.

Fortunately, Walter Faxon (1913) not long afterward found a female blue-winged warbler mated with a goldenwing and was successful in following the resulting brood of young birds until they had acquired their first winter plumage when, fulfilling Mendel's Law, they were all in "the garb of *Helminthophila leucobronchialis*," thus establishing beyond a doubt the hybrid nature of the bird. At the end of his paper, Walter Faxon (1913) relates a bit of interesting ancient history regarding these three species of *Vermivora*. He says:

> In my paper published in 1911, after stating the different hypotheses proposed in order to explain the relations existing among the Golden-winged, Blue-winged, Brewster's, and Lawrence's Warblers I added, half in jest, that the only hypothesis left for a new-comer in the field was this: that the Golden-winged and the Blue-winged Warblers themselves were merely two forms of one species. Curiously enough, not long after this I found that this very opinion had been expressed, and in a most unexpected quarter: in a letter dated Edinburgh, Sept. 15, 1835, Audubon wrote to Bachman that he suspected the golden-winged warbler and the blue-winged warbler were one species! That Audubon at that early date, ignorant (as he was assumed to be) of the existence of Brewster's and Lawrence's warblers, and but superficially acquainted with the golden-wing, should suspect that two birds so diverse as the blue-wing and the golden-wing were one species seemed incomprehensible, and in the light of what we now know about these birds, his surmise seemed to presuppose an almost superhuman faculty of prevision.
>
> As a possible explanation of Audubon's letter I have only this to offer: in the winter of 1876–77 Dr. Spencer Trotter discovered in the collection of the Academy of Natural Sciences of Philadelphia a specimen of Brewster's warbler without a label, the third specimen known up to that time; on the bottom of the stand was written in the autograph of John Cassin, "J. C., 20 October, 1862," and also a badly blurred legend "Not [note?] from Bell." An appeal to J. G. Bell elicited the response that he remembered shooting a peculiar warbler in Rockland Co., N. Y., about the year 1832—a warbler something like a golden-wing, but lacking, although in high plumage, the black throat of that species; a great many years afterward, he sold this specimen in Philadelphia but knew nothing of its ultimate fate. Dr. Trotter justly inferred that the Philadelphia Academy specimen was in all probability the very bird shot by Bell.
>
> Now as Audubon was intimately associated with Bell, is it not possible that he had examined this example of Brewster's warbler? In that case, seeing that this bird's characters were in part those of the blue-wing, in part those of the golden-wing, he may have inferred the interbreeding of these two birds, and so (rather unwarrantably, it is true) their identity. If this be not the explanation of the passage in Audubon's letter to Bachman I have no other to suggest.
>
> When Audubon came to publish his account of the Golden-winged Warbler in 1839 (Ornithological Biography, 1839, 5, p. 154) he said not a word about its connection with the Blue-winged Warbler.

Recently Karl W. Haller (1940) described "a new wood warbler from West Virginia" from two specimens, male and female, which he collected on May 30 and June 1, 1939, respectively, at points 18 miles apart, and proposed for it the new name *Dendroica potomac*, Sutton's warbler. These birds resemble the yellow-throated warbler in plumage but lack streaks on the sides. They also suggest the parula warbler in having a faint yellowish wash on the back and, in the male, "an almost imperceptible hint of raw sienna" on the upper breast. The male sang a song much like the parula's, but doubled by repetition.

Two more Sutton's warblers have been carefully observed in the field: one at the point where the type was collected on May 21, 1942, by Maurice Brooks and Bayard H. Christy (1942); the second about 18 miles to the westward on June 21, 1944, by George H. Breiding and

Lawrence E. Hicks (1945). Another aberrant warbler has been described by Stanley G. Jewett (1944), who examined four specimens which show a curious intermingling of the plumage characters of the hermit and Townsend warblers.

[AUTHOR'S NOTE: Since the above was written, Kenneth C. Parkes (1951) has published a study of the genetics of the golden-winged–blue-winged warbler complex, to which the reader is referred.]

MNIOTILTA VARIA (Linnaeus)

BLACK-AND-WHITE WARBLER

HABITS

CONTRIBUTED BY WINSOR MARRETT TYLER

PLATES 1–3

The black-and-white warbler is one of the earliest spring warblers to reach its breeding-ground in the Transition Zone. Most of the other members of this family arrive in or pass through the region in mid-May or somewhat later, according to the season, when the oaks are in bloom and the opening flowers attract swarms of insects.

The black-and-white warbler, however, owing to its peculiar habit of feeding on the trunks and the large limbs of the trees, does not have to wait for the bounty supplied by the oaks but finds its special feeding-ground well stocked with food long before the oaks blossom or their leaves unfold. It comes with the yellow palm warbler late in April, when many of the trees are nearly bare, and not long after the pine warbler.

Mniotilta is a neat little bird, dressed in modest colors, at this season singing its simple but sprightly song as it scrambles over the bark—the black-and-white creeper, Alexander Wilson calls it.

Milton B. Trautman (1940), speaking of the spring migration at Buckeye Lake, Ohio, shows that the male birds are preponderant in the earliest flights. He says: "The first spring arrivals, chiefly males, were noted between April 16 and 30, and between May 1 and 5, 2 to 15 birds, mostly males, could be daily noted. The peak of migration usually lasted from May 6 to May 18, and then from 3 to 42 individuals, consisting of a few old males and the remainder females and young males, were daily observed. On May 18 or shortly thereafter a decided lessening in numbers occurred, and by May 23 all except an occasional straggler had left."

Courtship.—Forbush (1929) gives this hint of courtship, which resembles the activities of most warblers at this season: "When the females arrive there is much agitation, and often a long-continued intermittent pursuit, with much song and fluttering of black and white plumage, and much interference from rival males before the happy pair are united and begin nesting."

Nesting.—The black-and-white warbler usually builds its nest on the ground, tucking it away against a shrub or tree, or even under the shelter of an overhanging stone or bank. The nest is generally concealed among an accumulation of dead leaves which, arching over it, hides it from above. It is made, according to A. C. Bent (MS.), "of dry leaves, coarse grass, strips of inner bark, pine needles and rootlets, and is lined with finer grasses and rootlets and horsehair." I have seen a nest made chiefly of pine needles on a base of dry leaves.

Henry Mousley (1916), writing of Hatley, Quebec, mentions moss as a component part of the nest, and says of three nests that they were all "heavily lined with long black and white horse hairs," a peculiarity of coloration mentioned in one of Mr. Bent's nests. Thomas D. Burleigh (1927b) speaks of a nest in Pennsylvania "built of dead leaves and rhododendron berry stems, lined with fine black rootlets and a few white hairs." H. H. Brimley (1941) describes an exceptional nest. He says: "There was no particular departure from normal in its construction except for the fact that it was lined with a mixture of fine rootlets and very fine copper wire, such as is used in telephone cables. Fragments of such cable, discarded by repair men, were found nearby where a telephone line ran through the woods."

Cordelia J. Stanwood (1910c) speaks of a nest "built in a depression full of leaves, behind a flat rock. * * * The cavity was shaped on a slant, the upper wall forming a partial roof. * * * It looked not unlike a small-sized nest of an Oven-bird. On the inside, the length was 2½ inches, width 1½ inches, depth 2 inches. On the outside, length 3½ inches, width 2½ inches, depth 2½ inches. Thickness of wall at the top of nest, 1 inch; at the bottom, ½ inch." Henry Mousley (1916) gives the average dimensions of three nests as "outside diameter 3¾, inside 1¾ inches; outside depth 2¼, inside 1½ inches."

F. A. E. Starr (MS.) writes to A. C. Bent from Toronto, Ontario, that all the nests he has found have been in broken-off stumps in low woods. "The cavity in the top of the stump," he says, "is filled with old leaves, and the nest proper is made chiefly of strips of bark with grass and fiber." Guy H. Briggs (1900) reports a nest "in a decayed hemlock stump, fifteen inches from the ground." In such cases, of course, while the nest is well above the ground level, it rests on a firm foundation.

Audubon (1841) says: "In Louisiana, its nest is usually placed in some small hole in a tree," but he quotes a letter to him from Dr.

T. M. Brewer on the subject, thus: "This bird, which you speak of as breeding in the hollows of trees, with us always builds its nest on the ground. I say always, because I never knew it to lay anywhere else. I have by me a nest brought to me by Mr. Appleton from Batternits, New York, which was found in the drain of the house in which he resided."

Minot (1877) speaks of two nests found near Boston, Mass., well above the ground. He says: "The first was in a pine grove, in the cavity of a tree rent by lightning, and about five feet from the ground, and the other on the top of a low birch stump, which stood in a grove of white oaks."

Gordon Boit Wellman (1905) states: "Toward the last of the incubation time one of the birds was constantly on the nest. I found the male sitting usually at about dusk, but I think the female sat on the eggs over night."

Eggs.—[AUTHOR'S NOTE: The black-and-white warbler usually lays 4 or 5 eggs to a set, normally 5, seldom fewer or more. These are ovate to short ovate and slightly glossy. The ground color is white or creamy white. Some are finely sprinkled over the entire surface with "cinnamon-brown," "Mars brown," and "dark purplish drab"; others are boldly spotted and blotched with "russet" and "Vandyke brown," with underlying spots of "brownish drab," "light brownish drab," and "light vinaceous-drab." Speckled eggs are commoner than the more boldly blotched type. The markings are usually concentrated at the large end, and on some of the heavily spotted eggs there is a solid wreath of different shades of russet and drab. The measurements of 50 eggs average 17.2 by 13.3 millimeters; the eggs showing the four extremes measure 18.8 by 13.7, 17.9 by 14.7, 15.7 by 12.7, and 16.3 by 12.2 millimeters (Harris).]

Young.—Cordelia J. Stanwood (MS.) speaks of the nestlings a few days from the egg as "very dark gray, much like young juncos and Nashville warblers." But when they leave the nest they are clearly recognizable as young black-and-white warblers, although they are slightly tinged with brownish. By mid-July, here in New England, they assume their first winter plumage, and, as both sexes of the young birds have whitish cheeks, they resemble very closely their female parent.

Unlike the young of some of the other warblers which remain near the ground for many days, the young black-and-white warblers shortly ascend to the branches of trees where they are fed by the old birds.

I find no definite record of the length of the incubation period, but in a nest I watched in 1914 it was close to 10 days. Burns (1921) gives the period of nestling life as 8 to 12 days.

Plumages.—[AUTHOR'S NOTE: Dr. Dwight (1900) calls the natal down mouse gray, and describes the juvenal plumage as follows: "Above, wood-brown streaked with dull olive-brown, the upper tail coverts dusky; median crown and superciliary stripe dingy white. Wings and tail dull black, edged chiefly with ashy gray, the tertiaries (except the proximal which is entirely black) broadly edged with white, buff tinged on the middle one. Two buffy white wing bands at tips of greater and median wing coverts. The outer two rectrices with terminal white blotches of variable extent on the inner webs. Below, dull white, washed on the throat and sides with wood-brown, obscurely streaked on throat, breast, sides and crissum with dull grayish black."

A postjuvenal molt begins early in July, involving everything but the flight feathers; this produces in the young male a first winter plumage which is similar to the juvenal, but whiter and more definitely streaked. "Above, striped in black and white, the upper tail coverts black broadly edged with white; median crown and superciliary stripe pure white. The wing bands white. Below, pure white streaked with bluish black on sides of breast, flanks and crissum, the black veiled by overlapping white edgings; the chin, throat, breast and abdomen unmarked. Postocular stripe black; the white feathers of the sides of the head tipped with black."

The first nuptial plumage is acquired by a partial prenuptial molt in late winter, which involves a large part of the body plumage, but not the wings or the tail. "The black streaks of the chin and throat are acquired, veiled with white, and the loral, subocular and auricular regions become jet-black. The brown primary coverts distinguish young birds and the chin is less often solidly black than in adults."

The adult winter plumage is acquired by a complete postnuptial molt, beginning early in July. It differs from the first winter dress "in having the chin and throat heavily streaked with irregular chains of black spots veiled with white edgings, the wings and tail blacker and the edgings a brighter gray. * * * The female has corresponding plumages and moults, the first prenuptial moult often very limited or suppressed. In juvenal dress the wings and tail are usually browner with duller edgings and the streaking below obscure. In first winter plumage the streakings are dull and obscure everywhere, a brown wash conspicuous on the flanks and sides of the throat. The first nuptial plumage is gained chiefly by wear through which the brown tints are largely lost, the general color becoming whiter and the streaks more distinct. The adult winter plumage is rather less brown than the female first winter, the streaking less obscure and the wings and tail darker. The adult nuptial plumage, acquired partly by moult, is indistinguishable with certainty from the first nuptial."]

Food.—McAtee (1926) summarizes the food of the species thus:

> In its excursions over the trunks and larger limbs of trees the Black and White Creeper is certainly not looking for vegetable food, and only a trace of such matter has been found in the stomachs examined. The food is chiefly insects but considerable numbers of spiders and daddy-long-legs also are eaten. Beetles, caterpillars, and ants are the larger classes of insect food, but moths, flies, bugs, and a few hymenoptera also are eaten. Among forest enemies that have been found in stomachs of this species are round-headed wood borers, leaf beetles, flea beetles, weevils, bark beetles, leaf hoppers, and jumping plant lice. The hackberry caterpillar, the hackberry psyllid, an oak leaf beetle *Xanthonia 10-notata,* and the willow flea beetle, are forms specifically identified. Observers have reported this warbler to feed also upon ordinary plant lice, and upon larvae of the gypsy moth.

Forbush (1929) adds the following observation: "The food of this bird consists mostly of the enemies of trees, such as plant-lice, scale-lice, caterpillars, both hairy and hairless, among them such destructive enemies of orchard, shade and forest trees as the canker-worm and the gipsy, brown-tail, tent and forest tent caterpillars. Wood-boring and bark-boring insects, click beetles, curculios and many other winged insects are taken. Sometimes when the quick-moving insects escape its sharp bill, it pursues them on the wing but most of its attention is devoted to those on the trees."

H. H. Tuttle (1919), speaking of the male parent feeding the young birds, says: "The fare which he provided was composed entirely of small green caterpillars, cut up into half-lengths."

Behavior.—The black-and-white warbler seems set apart from others of the group, perhaps because of its marked propensity for clambering over the trunks of trees and their larger branches. Although, like other warblers, it seems at home among the smaller twigs, it spends a large part of its time on upright surfaces over which it moves easily and quickly, upward, downward, and spirally, with great agility and sureness of footing, constantly changing direction, and not using the tail for support. As it scrambles over the bark, it switches from side to side as if at each hop it placed one foot and then the other in advance, and even on slim branches it hops in the same way, the tail alternately appearing first on one side of the branch and then on the other; it reminds us of a little schoolgirl swishing her skirt from side to side as she walks down the street. The bird is alert and watchful, and if it starts an insect from the bark, or sees one flying near, it may pursue it and catch it in the air.

H. H. Tuttle (1919) describes an extreme example of behavior simulating a wounded bird. He says: "She struck the leaves with a slight thud and turned over on her side, while the toes of one up-stretched leg clutched at the air and her tail spread slowly into a pointed fan. * * * Deceived for a moment then, I turned a step in her direction. She lay quite still except for a quivering wing. I reached out toward her with a small stick and touched her side; she screamed pitifully; I stretched out my hand to pick her up, but with a last effort she righted herself, and by kicking desperately with one leg, succeeded in pushing forward a few inches."

We associate this warbler with dry, rocky hillsides where the ground is strewn with dead leaves, but the bird may breed also in the dry portions of shady, wooded swamps.

Voice.—The black-and-white is one of the high-voiced singers. Its song is made up of a series of squeaky couplets given with a back-and-forth rhythm, a seesawing effect, like the ovenbird's song played on a fine, delicate instrument. It may be suggested by pronouncing the syllables *we see* rapidly four or five times in a whispered voice. In the distance the song has a sibilant quality; when heard near at hand a high, clear whistle may be detected in the notes. The final note in the song is the accented *see.*

Albert R. Brand (1938), in his mechanically recorded songs of warblers, placed the black-and-white's song as the fourth highest in pitch in his last of 16 species, the blackpoll, blue-winged, and the Blackburnian being higher. He gives the approximate mean (vibrations per second of the black and white as 6,900 and of the blackpool as 8,900.

Aretas A. Saunders (MS.) says: "The pitch of the songs varies, according to my records, from B''' to E'''', a range of three and a half tones more than an octave. A single song, however, does not vary more than three and a half tones."

A second song, not heard, I think, until the bird has been on its breeding ground for some time, is rather more pleasing, less monotonous, than the first. It is longer, somewhat faster, more lively, and is modulated in pitch. Francis H. Allen (MS.) speaks of it thus: "Later in the season a more elaborate song is very commonly heard. I have been accustomed to syllabify it as *weesy*, *weesy*, *weesy*, *weesy*, *woosy*, *woosy*, *weesy*, *weesy*. The notes indicated by *woosy* really differ from the others only by being pitched lower."

Occasionally we hear aberrant songs which prove puzzling until we can see the singer. Allen remarks that he has heard several such songs, and I remember hearing one in which the lower note of each couplet was reduplicated, thereby strongly suggested one of the songs of the Blackburnian warbler. Sometimes *Mniotilta* sings during flight. I once heard a song from a bird flying within a few feet of me—at this range a sound of piercing sharpness.

Of the minor notes Andrew Allison (1907) says: "I know of no other warbler except the Chat that can produce so great a variety of sounds; and since nearly all of the notes resemble those of other warblers, this is a most confusing bird to deal with during the busy season of 'waves'."

The call note often has a buzzing quality, and often runs into a long chatter (also characteristic of the young bird), but it may be given so sharply enunciated that it suggests the *chip* of the blackpoll. Allen (MS.) writes it *chi*, "like pebbles struck together," and Cordelia J. Stanwood (1910) renders it *sptz*, saying "the sound resembled the noise made by a drop of syrup sputtering on a hot stove."

Field marks.—The blackpoll, in its spring plumage, and the black-and-white warbler resemble each other in coloration, but the latter bird may be readily distinguished by its white stripe down the center of the crown and the white line over the eye. The contrast in the behavior of the two birds separates them at a glance.

Enemies.—Like other birds which build on the ground, the black-and-white is subject, during the nesting season, to attacks by snakes and predatory mammals. A. D. DuBois (MS.) cites a case in which maggots destroyed a nestful of young birds.

Harold S. Peters (1936) reports that a fly, *Ornithoica confluens* Say, and a louse, *Myrsidea incerta* (Kellogg), have been found in the plumage of the black-and-white warbler.

Herbert Friedmann (1929) says: "This aberrant warbler is a rather uncommon victim of the Cowbird, only a couple dozen definite instances having come to my notice. * * * The largest number of Cowbirds' eggs found in a single nest of this Warbler is five, together with three eggs of the owner." George W. Byers (1950) reports a nest of this warbler, in Michigan, that held two eggs of the warbler and eight of the cowbird, on which the warbler was incubating. His photograph of the eggs suggests that they were probably laid by four different cowbirds.

Fall.—Several of the warblers show a tendency to stray from their breeding grounds soon after their young are able to care for themselves, perhaps even before the postnuptial molt is completed and long before the birds gather into the mixed autumn flocks. Among these early wandering birds the black-and-white warbler is a very conspicuous species, perhaps because it is one of our commoner birds or, more probably, because of its habit of feeding in plain sight on the trunks and low branches of dead or dying trees and shrubs instead of hiding, like other warblers, high up in the foliage. It may be that the warblers we see at some distance from their breeding grounds thus early in the season have already begun their migration toward the south: they often appear to be migrating.

Behind the house in Lexington, Mass., where I lived for years, there was a little hill, sparsely covered with locust trees, to the southward from my dooryard. This hill was a favorite resort for warblers in late summer. No warbler bred within a mile of the spot, except the summer yellowbird, to use the old name, yet soon after the first of July the black-and-white warblers began to assemble there. Not infrequently I have seen a single bird come to the hill, flying in from the north across Lexington Common, and join others there. The small company might remain for an hour or more, frequently singing (evidently adult males) as the birds fed in the locust trees.

Later in the season, as August advances, migration appears more evident. The birds now gather in larger numbers, sometimes as many as eight or ten; they pause in the locust trees for a shorter time before flying off; they are no longer in song; and the majority of the birds have white cheeks, most of them presumably young birds. Although they are almost silent as they climb about feeding, if you stand quietly in the midst of a company of four or five, now and then you may hear a faint note, and at once the note comes from all sides, each bird apparently reporting its whereabouts—a sound which calls to mind the south-bound migrants as they roam through the quiet autumn woods. Other warblers, unquestionably migrants, visit this hillside in August, notably the Tennessee, an early arrival who has already traveled a long way.

The fall migration of the black-and-white is long-drawn-out. The bird does not depend, like many of the warblers, on finding food among the foliage, so it may linger long after the trees are bare of leaves, sometimes, here in New England, well into October. I saw a bird in eastern Massachusetts on October 23, 1940, a very late date.

Winter.—Dr. Alexander F. Skutch (MS.) sent to A. C. Bent the following comprehensive account of the bird on its winter quarters: "None of our warblers is more catholic in its choice of a winter home than the black-and-white. Upon its departure from its nesting range, it spreads over a vast area from the Gulf States south to Ecuador and Venezuela, from the Pacific coast of Mexico and Central America eastward through the Antilles. And in the mountainous regions of its winter range it does not, like so many members of the family, restrict itself to a particular altitudinal zone, but on the contrary scatters from sea level high up into the mountains. As a result of this wide dispersion, latitudinal and altitudinal, it appears to be nowhere abundant in Central America during the winter months, yet it has been recorded from more widely scattered localities than most other winter visitants. On the southern coast of Jamaica, in December 1930, I found a greater concentration of individuals than I have ever seen in Central America during midwinter.

"Wintering throughout the length of Central America, from near sea level up to 9,000 feet and rarely higher, the black-and-white warbler is somewhat more abundant in that portion of its altitudinal range comprised between 2,000 or 3,000 and 7,000 or 8,000 feet above sea level. It is found in the heavy forest, in the more open types of woodland, among the shade trees of the coffee plantations, and even amid low second-growth with scattered trees. It creeps along the branches in exactly the same fashion in its winter as in its summer home. Solitary in its disposition, two of the kind are almost never seen together. The only time I have heard this warbler sing in Central America was also one of the very few occasions when I found two together. Early on the bright morning of September 1, 1933, when the warblers were arriving from the north, I heard the black-and-white's weak little song repeated several times among the trees at the edge of an oak wood, at an altitude of 8,500 feet in the Guatemalan highlands. Looking into the tree tops, I saw two of these birds together. Apparently they were singing in rivalry, as red-faced warblers, Kaup's redstarts, yellow warblers, and other members of the family solitary during the winter months will sing in the face of another of their kind, at seasons when they are usually silent. Often such songs lead to a pursuit or even a fight; but I have never seen black-and-white warblers actually engaged in a conflict in their winter home.

"Although intolerant of their own kind, the black-and-white warblers are not entirely hermits; for often a single one will attach itself to a mixed flock of small birds. In the Guatemalan highlands, during the winter months, such flocks are composed chiefly of Townsend's warblers; and each flock, in addition to numbers of the truly gregarious birds, will contain single representatives of various species of more solitary disposition, among them often a lone black-and-white, so different in appearance and habits from any of its associates.

"This warbler arrives and departs early. It has been recorded during the first week of August in Guatemala, and by the latter part of the month in Costa Rica and Panamá. In Costa Rica, it appears not to linger beyond the middle or more rarely the end of March; while for northern Central America my latest date is April 22.

"Early dates of fall arrival in Central America are: Guatemala—passim (Griscom), August 3; Sierre de Tecpán, August 23, 1933; Santa María de Jesús, August 6, 1934; Huehuetenango, August 14, 1934. Honduras—Tela, August 19, 1930. Costa Rica—San José (Cherrie), August 20; Carrillo (Carriker), September 1; San Isidro de Coronado, September 8, 1935; Basin of El General, September 19, 1936; Vara Blanca, September 5, 1937; Murcia, September 11, 1941. Panamá—Canal Zone (Arbib and Loetscher), August 24, 1933, and

August 29, 1934. Ecuador— Pastaza Valley, below Baños, October 17, 1939.

"Late dates of spring departure from Central America are: Costa Rica— Basin of El General, February 23, 1936, March 10, 1939, March 26, 1940, March 3, 1942, March 18, 1943; Vara Blanca, March 13, 1938; Guayabo (Carriker), March 30; Juan Viñas (Carriker), March 21. Honduras—Tela, April 22, 1930. Guatemala—Motagua Valley, near Los Amates, April 17, 1932; Sierra de Tecpán, February 20, 1933."

The bird has a wide winter range, as shown above. Dr. Thomas Barbour (1943) speaks of it thus in Cuba: "Common in woods and thickets. A few arrive in August, and by September they are very abundant, especially in the overgrown jungles about the Ciénaga."

Edward S. Dingle (MS.) has sent to A. C. Bent a remarkable winter record of a black-and-white warbler seen on Middleburg plantation, Huger, S. C., on January 13, 1944.

DISTRIBUTION

Range.—Canada to northern South America.

Breeding range.—The black-and-white warbler breeds **north** to southwestern Mackenzie, rarely (Simpson and Providence; has been collected at Norman); northern Alberta (Chipewyan and McMurray); central Saskatchewan (Flotten Lake, probably Grand Rapids, and Cumberland House); southern Manitoba (Duck Mountain, Lake St. Martin, Winnipeg, and Indian Bay); central Ontario (Kenora, Pagwachuan River mouth, and Lake Abitibi; has occurred at Piscapecassy Creek on James Bay, and at Moose Factory); southern Quebec (Lake Tamiskaming, Blue Sea Lake, Quebec, Mingan, and Mascanin; has occurred at Sandwich Bay, Labrador); and central Newfoundland (Deer Lake, Nicholsville, Lewisport, and Fogo Island). **East** to Newfoundland (Fogo Island and White Bear River); Nova Scotia (Halifax and Yarmouth); the Atlantic coast to northern New Jersey (Elizabeth and Morristown); eastern Pennsylvania (Berwyn); Maryland (Baltimore and Cambridge); eastern Virginia (Ashland and Lawrenceville); North Carolina (Raleigh and Charlotte); South Carolina (Columbia and Aiken); and central Georgia (Augusta and Milledgeville). **South** to central Georgia (Milledgeville); south central Alabama (Autaugaville); north-central Mississippi (Starkville and Legion Lake); northern Louisiana (Monroe; rarely to southern Louisiana, Bayou Sora); and northeastern and south-central Texas (Marshall, Dallas, Classen, Kerrville, and Junction). **West** to central Texas (Junction and Palo Dura Canyon); central Kansas (Clearwater); central-northern Nebraska (Valentine); possibly eastern Montana (Glasgow); central Alberta (Camrose, Glenevis, and Lesser

Slave Lake); to southwestern Mackenzie (Simpson). There is a single record of its occurrence in June at Gautay, Baja California, 25 miles south of the international border.

Winter range.—In winter the black-and-white warbler is found **north** to southern Texas (Cameron County, occasionally Cove, and Texarkana); central Mississippi, occasionally (Clinton); accidental in winter at Nashville, Tenn.; southern Alabama (Fairfield); southern Georgia (Lumber City, occasionally Milledgeville, and Athens); and rarely to central-eastern South Carolina (Edisto Island and Charleston). **East** to the coast of South Carolina, occasionally (Charleston); Georgia (Blackbeard Island); Florida (St. Augustine, New Smyrna, and Miami); the Bahamas (Abaco, Watling, and Great Abaco Islands); Dominican Republic (Samana); Puerto Rico; Virgin Islands and the Lesser Antilles to Dominica; and eastern Venezuela (Paria Peninsula). **South** to northern Venezuela (Paria Peninsula, Rancho Grande, and Mérida); west-central Colombia (Bogotá); and central Ecuador (Pastazo Valley). **West** to central and western Ecuador (Pastazo Valley and Quito); western Colombia (Pueblo Rico); western Panamá (Dvala); El Salvador (Mount Cacaguatique); western Guatemala (Mazatenango); Guerrero (Acapulco and Coyuca); Colima (Manzanillo); northwestern Pueblo (Metlatayuca); western Nuevo León (Monterey); and southern Texas (Cameron County). It also occurs casually in the Cape region of Baja California and in southern California (Dehesa and Carpenteria). There are also several records in migration from California and from western Sinaloa.

Migration.—Late dates of spring departure from the winter home are: Venezuela—Yacua, Paria Peninsula, March 20. Colombia—Santa Marta region, March 12. Panamá—Gatún, March 26. Costa Rica—El General, April 9. Honduras—Tola, April 22. Guatemala—Quiriguá, April 17. Veracruz—El Conejo, May 15. Puerto Rico—Algonobo, April 27. Haiti—Île à Vache, May 6. Cuba—Habana, May 25. Bahamas—Abaco, May 6. Florida—Orlando, May 21. Georgia—Cumberland, May 26. Louisiana—Avery Island, April 27.

Early dates of spring arrival are: South Carolina—Clemson College, March 20. North Carolina—Weaverville, March 3. Virginia—Lawrenceville, March 23. District of Columbia—Washington, March 30. New York—Corning, April 18. Massachusetts—Stockbridge, April 16. Vermont—St. Johnsbury, April 19. Maine—Lewiston, April 27. Quebec—Montreal, April 26. Nova Scotia—Wolfville, April 29. Mississippi—Deer Island, March 4. Louisiana—Schriever, March 8. Arkansas—March 12. Tennessee—Nashville, March

20. Illinois—Chicago, April 17. Michigan—Ann Arbor, April 6. Ohio—Toledo, April 7. Ontario—Guelph, April 22. Missouri—Marionville, April 3. Iowa—Grinnell, April 16. Wisconsin—Milwaukee, April 20. Minnesota—Lanesboro, April 23. Kansas—Independence, April 1. Omaha—April 21. North Dakota—April 28. Manitoba—Winnipeg, April 28. Alberta—Edmonton, May 6; McMurray, May 15. Mackenzie—Simpson, May 22.

Late dates of fall departure are: Alberta—Athabaska Landing, September 11. Manitoba—Aweme, September 22. North Dakota—Argusville, October 2. Minnesota—Minneapolis, October 10. Iowa—Davenport, October 1. Missouri—Columbia, October 24. Wisconsin—Madison, October 7. Illinois—Port Byron, October 15. Ontario—Hamilton, October 3. Michigan—Detroit, October 15. Ohio—Youngstown, October 15. Kentucky—Danville, October 14. Tennessee—Athens, October 17. Arkansas—Winslow, October 17. Louisiana—New Orleans, October 25. Mississippi—Gulfport, November 19. Quebec—Quebec, September 18. New Brunswick—St. John, September 19. Nova Scotia—Yarmouth, September 23. Maine—Portland, October 17. New Hampshire—Ossipee, October 18. Massachusetts—Cambridge, October 15. New York—New York, October 6. Pennsylvania—Atglen, October 29. District of Columbia—Washington, October 18. Virginia—Charlottesville, October 18. North Carolina—Raleigh, October 29. South Carolina—Charleston, November 15. Georgia—Savannah, October 29.

Early dates of fall arrival are: South Carolina—Charleston, July 19. Florida—Pensacola, July 12. Cuba—Artemisa, Pinar del Río, August 1. Dominican Republic—Ciudad Trujillo, September 27. Puerto Rico—Mayagüez, October 9. Louisiana—New Orleans, July 21. Mississippi—Bay St. Louis, July 4. Michoacán—Tancitaro, August 7. Guatemala—Huehuetenango, August 14. Honduras—Cantarranas, August 7. Costa Rica—San José, August 20. Panamá—Tapia, Canal Zone, August 24. Colombia—Bonda, Santa Marta region, August 21. Ecuador—Pastaza Valley, October 17. Venezuela—Estado Carabobo Las Trincheras, October 9.

Banding.—A single banding recovery is of considerable interest: A black-and-white banded at Manchester, N. H., on August 31, 1944, was found on March 17, 1945, at Friendship P. O., Westmoreland, Jamaica.

Casual records.—This warbler is casual in migration or winters in Bermuda, having been recorded in six different years from October to May.

At Tingwall, Shetland Islands, north of Scotland one was picked up on November 28, 1936. This is almost as far north as the northernmost record of occurrence in North America and later than it is normally found in the United States.

A specimen was collected near Pullman, Wash., on August 15, 1948, the first record for the State.

Egg dates.—Massachusetts: 31 records, May 18 to June 14; 17 records, May 25 to June 3, indicating the height of the season.

New Jersey: 7 records, May 18 to June 8.

Tennessee: 3 records, May 1 to 17.

North Carolina: 6 records, April 20 to 28.

West Virginia: 7 records, May 6 to 29 (Harris).

PROTONOTARIA CITREA (Boddaert)

PROTHONOTARY WARBLER

PLATES 4–6

HABITS

I do not like the above name for the golden swamp warbler. The scientific name *Protonotaria*, and evidently the common name, were apparently both derived from the Latin *protonotarius*, meaning first notary or scribe. I sympathize with Bagg and Eliot (1937), who exclaimed:

> What a name to saddle on the Golden Swamp-bird! Wrongly compounded in the first place, wrongly spelled, wrongly pronounced! We understand that Protonotarius is the title of papal officials whose robes are bright yellow, but why say "First Notary" in mixed Greek and Latin, instead of Primonotarius? Proto is Greek for first, as in prototype. Why and when did it come to be misspelled Protho? Both Wilson and Audubon wrote Protonotary Warbler, a name seemingly first given to the bird by Louisiana Creoles. Both etymology and sense call for stress on the third syllable, yet one most often hears the stress laid on the second. Here, certainly, is a bothersome name fit only to be eschewed!

The scientific name cannot be changed under the rules of nomenclature, but a change in the common name would seem desirable. However, the name does not make the bird or detract from its charm and beauty. It will still continue to thrill with delight the wanderer in its swampy haunts.

The center of abundance of the prothonotary warbler as a breeding bird in this country is in the valleys of the Mississippi River and its tributaries, notably the Ohio, the Wabash, and the Illinois Rivers. Its summer range extends eastward into Indiana and Ohio, northward into southern Ontario, Wisconsin, Michigan, and Minnesota, and westward into Iowa, Nebraska, Kansas, Oklahoma, and eastern Texas—wherever it can find suitable breeding grounds.

It also breeds in the Atlantic Coast States from Virginia to Florida.

It is essentially a bird of the damp and swampy river bottoms and low-lying woods, which are flooded at times and in which woodland pools have been left by the receding water. Perhaps this warbler abounds more than anywhere else in the valley of the lower Wabash, where William Brewster (1878) found it to be—

> one of the most abundant and characteristic species. Along the shores of the rivers and creeks generally, wherever the black willow (*Salix niger*) grew, a few pairs were sure to be found. Among the button-bushes (*Cephalanthus occidentalis*) that fringed the margin of the peculiar long narrow ponds scattered at frequent intervals over the heavily timbered bottoms of the Wabash and White Rivers, they also occurred more or less numerously. Potoka Creek, a winding, sluggish stream, thickly fringed with willows, was also a favorite resort; but the grand rendezvous of the species seemed to be about the shores of certain secluded ponds lying in what is known as the Little Cypress Swamp. Here they congregated in astonishing numbers, and early in May were breeding almost in colonies. In the region above indicated two things were found to be essential to their presence, namely, an abundance of willows and the immediate proximity of water. * * * So marked was this preference, that the song of the male heard from the woods indicated to us as surely the proximity of some river, pond, or flooded swamp, as did the croaking of frogs or the peep of the Hylas.

Dr. Chapman (1907) writes of this bird in its haunts:

> The charm of its haunts and the beauty of its plumage combine to render the Prothonotary Warbler among the most attractive members of the family. I clearly recall my own first meeting with it in the Suwanee River region of Florida. Quietly paddling my canoe along one of the many enchanting, and, I was then quite willing to believe, enchanted streams which flowed through the forests into the main river, this glowing bit of bird-life gleamed like a torch in the night. No neck-straining examination with opera-glass pointed to the treetops, was required to determine his identity, as, flitting from bush to bush along the river's bank, his golden plumes were displayed as though for my special benefit.

Dr. Lawrence H. Walkinshaw (1938) says that the golden swamp warbler "nests rather abundantly along southwestern-Michigan rivers. * * * Winding streams, bordered densely with oak, maple, ash, and elm, shallow ponds with groups of protrudnig willows and flooded, heavily shaded bottom-lands are favorite nesting habitats for the Prothonotary Warbler (*Protonotaria citrea*). Such habitats occur along the banks of the Kalamazoo River and its tributary the Battle Creek River in Calhoun County, Michigan."

Territory.—The males arrive on the breeding grounds a few days or a week before the females come and immediately try to establish their territories, select the nesting sites, and even build nests. Dr. Walkinshaw (1941) writes:

> The Prothonotary Warbler is a very strongly territorial species. When a male takes possession of a certain area he continually drives off all opponents

> if he is able. At certain areas in Michigan I have watched these birds battle intermittently for two or three days, usually for the same bird house, one male finally taking possession. In addition I have observed them to drive off House Wrens (*Troglodytes aedon*), Black-capped Chickadees (*Penthestes atricapillus*) and Yellow Warblers (*Dendroica aestiva*). * * * The male Prothonotary Warbler selects the territory, selecting the nesting site before he becomes mated for the first nest, but thereafter both birds inspect the new nest sites.

On observations made near Knoxville, Tenn., Henry Meyer and Ruth Reed Nevius (1943) found that—

> three males established territories. Male I arrived April 14. By the next day he was singing on an area 550 feet long and for the most part not more than 200 feet wide. It included three kinds of habitats: (a) a grassy terrace on which several nesting boxes were located, (b) river banks densely covered with small trees and bushes, and (c) a small open orchard which constituted the connecting link between the terrace and the river bank. Male II arrived on April 18 and occupied a narrow territory along a brook confined by wooded slopes and which contained two lotus ponds. The area was about 400 feet long and 100 feet wide. A nesting box was on a stake above one of the ponds. Male III appeared May 5 in the terraced area being claimed by Male I. During the day, the 2 males sang energetically and flew often only a few inches apart. Male I maintained his territory and Male III disappeared.

There were a number of nesting boxes on the area that the males investigated, carrying nesting material into some of them while they were waiting for the females to arrive. The mate of the first male came on April 20, and—

> on this day this pair communicated by their full call-note. Twice the male was seen pursuing the female rapidly in a small semi-circle and pausing, called a soft, full note which was later heard only when the two sexes were together.
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> The mate of Male II came April 22, four days after the latter's arrival.
>
> Combat with other species found within the territories of these birds was observed. Combat with the Bluebird was most frequent but one or more indications of opposition was noticed with the Flicker, Downy Woodpecker, Acadian Flycatcher, Tufted Titmouse, Robin, and Cardinal.

The males sing persistently and energetically from the time that they arrive on their territories, hoping to attract their mates, but they are not always successful, especially in regions where the species is rare or not very common, and their nest-building brings no occupant. Edward von S. Dingle writes to me that, at Summerton, S. C., a male prothonotary warbler built a nest in a low stub, but no female was ever seen. He sang frequently and remained in the vicinity for several weeks. And Frederic H. Kennard, in far-away Massachusetts, mentions in his notes that he saw one and watched it for several days, June 16–20, 1890. "He sang loudly and clearly and sweetly, and seemed to like a particular place by the side of the river, for when I returned later in the day, he was still there, on the other side of the river." On June 19, he watched him for half an hour. He was always in the same locality. On a later search, no nest or no mate could be found.

Courtship.—Brewster (1878a) gives the following full account of this performance:

> Mating began almost immediately after the arrival of the females, and the "old, old story" was told in many a willow thicket by the little golden-breasted lovers. The scene enacted upon such occasions was not strikingly different from that usual among the smaller birds; retiring and somewhat indifferent coyness on the part of the female; violent protestations and demonstrations from the male, who swelled his plumage, spread his wings and tail, and fairly danced around the object of his affections. Sometimes at this juncture another male appeared, and then a fierce conflict was sure to ensue. The combatants would struggle together most furiously until the weaker was forced to give way and take to flight. On several occasions I have seen two males, after fighting among the branches for a long time, clinch and come fluttering together to the water beneath, where for several minutes the contest continued upon the surface until both were fairly drenched. The males rarely meet in the mating season without fighting, even though no female may be near. Sometimes one of them turns tail at the outset; and the other at once giving chase, the pursuer and pursued, separated by a few inches only, go darting through the woods, winding, doubling, now careering away up among the tree-tops, now down over the water, sweeping close to the surface until the eye becomes weary with following their mad flight. During all this time the female usually busies herself with feeding, apparently entirely unconcerned as to the issue. Upon the return of the conqueror her indifference, real or assumed, vanishes, he receives a warm welcome, and matters are soon arranged between them.

Nesting.—The prothonotary warbler and Lucy's warbler are the only two American warblers that habitually build their nests in cavities, usually well concealed. The normal, and probably the original, primitive, nestling sites are in natural cavities in trees and most nests are still to be found in such situations today. The prothonotary is not at all particular as to the species of trees, nests having been found in many kinds of trees, although perhaps a slight preference is shown for dead willow stumps. Nor is it particular as to the size or condition of the cavity, or its location, though quite often choosing one over water or near it. The height above the ground or water varies from 3 feet or less to as much as 32 feet but there are more nests below 5 feet than there are above 10, the height of the majority being between 5 and 10 feet. The size and shape of the cavity are of little concern; if the cavity is too deep, the industrious little birds fill it with nesting material up to within a few inches of the top; sometimes a very shallow cavity is used, so that the bird can be plainly seen from a distance as it sits on the nest. The old deserted holes of woodpeckers or chickadees are favorite nesting sites; the entrances to these have often been enlarged by other agencies, or are badly weathered. In very rotten stumps, the warblers have been known to excavate partially or to enlarge a cavity.

The nests built by the males in early spring, referred to above, are probably rarely used as brood nests and might be classed as dummy nests. The family nest is built almost entirely by the female, with encouragement and a little help from her mate, who accompanies her to and from the nest and in the search for material; much of the soft, green moss used extensively in the nest is often obtainable from fallen logs and stumps in the vicinity.

Brewster (1878a) mentions a nest taken from a deep cavity that "when removed presents the appearance of a compact mass of moss five or six inches in height by three or four in diameter. When the cavity is shallow, it is often only scantily lined with moss and a few fine roots. The deeper nests are of course the more elaborate ones. One of the finest specimens before me is composed of moss, dry leaves, and cypress twigs. The cavity for the eggs is a neatly rounded, cup-shaped hollow, two inches in diameter by one and a half in depth, smoothly lined with fine roots and a few wing-feathers of some small bird."

In Dr. Walkinshaw's (1938) Michigan nests, "moss constituted the bulk of the nesting material in nearly all cases, completely filling the nest space whether it was large or small. On top of this the nest proper was shaped and a rough lining of coarse grape-bark, dead leaves, black rootlets procured from the river-banks, and poison-ivy tendrils was added. Above this a lining of much finer rootlets, leaf-stems, and very fine grasses was used."

In addition to the materials listed above Meyer and Nevius (1943) mention hackberry leaves, hairs, pine needles, horsehair, and cedar bark in their Tennessee nests. They say that from 6 to 10 days were required for nest construction, and that from 3 to 5 days more elapsed before the first eggs were laid. Their four nests were all in bird-boxes; one was in an orchard over plowed ground, one over a lotus pond in a wooded ravine, and two were over lily pools near buildings.

Dr. Walkinshaw (1938) publishes a map showing the location of 21 nesting boxes along the winding banks of the Battle Creek River, in Calhoun County, Mich., and writes: "Of the 28 nests found during 1937, 19 were in bird-houses over running water, 6 were in stubs over water (2 of which were over running water), and the other 3 were in natural holes back from the river bank. Of 44 nests found from 1930 through 1937, excluding the 21 in bird-houses, six were over running water in old woodpecker holes, one in a bridge-support in a slight depression, and nine in natural holes over standing water. Seven were in old woodpecker holes from two to a hundred and sixty feet back from the river-bank."

Many and varied are the odd nesting sites occupied by prothonotary warblers. Dr. Thomas S. Roberts (1936) writes:

> The vagaries of this bird in choosing artificial nesting-places are shown by the positions of the following nests. On the La Crosse railroad bridge: in a cigar-box nailed on the engine-house on top of the draw; on one of the piers; in a metal ventilator-cap four inches in diameter, that had fallen and lodged just at the point where the draw banged against the pier, and close under the tracks; in a shallow cavity in a piece of slab-wood nailed to a trestle-support close under the road-bed of the railroad; these all far out in the middle of the Mississippi River. Still others are: in a Bluebird box on a low post by a switching-house and busy railroad platform; in a cleft in a pile in the river; in a tin cup in a barn, to reach which the birds entered through a broken pane of glass; in a pasteboard box on a shelf in a little summer-house; in an upright glass fruit jar in a house-boat; and other similar situations. In most cases the birds had to carry the nesting-material long distances, especially to the places on the bridge.

John W. Moyer (1933) relates an interesting story that was told to him by people living in a farm house along the Kankakee River. A pair of these warblers built their nests and raised their broods for three consecutive seasons in the pocket of an old hunting-coat, hung in a garage; each year the man cleaned out the nest and used the coat in the fall, and the next spring the birds used it again. M. G. Vaiden tells me of a similar case.

Nests have been found in buildings, on beams and other supports. Louis W. Campbell (1930) reports two on shelves in sheds, one in a small paper sack partly filled with staples and another in a coffee can similarly filled. Nests in cans in various situations have been found a number of times, and others have been reported in a tin pail hung under a porch, in a mail box, in a box on a moving ferry boat, in a Chinese lantern on a pavilion, and in an old hornets' nest.

Dr. Walkinshaw writes to me: "At Reelfoot Lake, Tenn., during July, 1940, I found 8 nests of the prothonotary warbler, all built a few feet above the water in small natural holes in cypress knees. Evidently these are regular late-summer nesting sites." The knees were farther under water earlier in the season. Most of his 76 Michigan nests were over water, or less than 100 feet from it; but 10 were 300 or more feet away from it and 2 were over 400 feet away. M. G. Vaiden tells me of a pair that nested in the tool box of a log-loading machine that was in daily operation, hauling logs.

Eggs.—From 3 to 8 eggs have been found in nests of the prothonotary warbler, from 4 to 6 seem to be the commonest numbers, 7 is a fairly common number, and at least 3 sets of 8 have been reported; in the J. P. Norris series of 70 sets are 34 sets of 6, 15 sets of 7, and 2 sets of 8.

The eggs vary in shape from ovate to short ovate, and they are more or less glossy. The eggs are undoubtedly the most striking of the warblers' eggs, with their rich creamy, or rose-tinted cream, ground color, boldly and liberally spotted and blotched with "burnt umber," "bay," "chestnut brown," and "auburn," intermingled with spots and undertones of "light Payne's gray," "Rood's lavender," "violet-gray," and "purplish gray." There is quite a variation in the amount of markings, which are generally more or less evenly scattered over the entire egg; some are sparingly spotted and blotched, while others are so profusely marked as almost to obscure the ground color (Harris).

J. P. Norris (1890b), in his description of his 70 sets, describes 2 eggs in each of 2 sets as "unmarked, save for four or five indistinct specks of cinnamon." These were in sets of 6 eggs each. Pure white, unmarked eggs were once taken by R. M. Barnes (1889). Dr. Walkinshaw (1938) gives the measurements of 78 eggs as averaging 18.47 by 14.55 millimeters; the eggs showing the four extremes measured 20 by 15, 19 by 16, and 17 by 13 millimeters.

Incubation.—The eggs are laid, usually one each day, very early in the morning; Dr. Walkinshaw (1941) says between 5:00 and 7:00 a. m. in Michigan; Meyer and Nevius (1943), in Tennessee, saw the female enter the nest to lay as early as 5:00 a. m. on May 2, and as early as 4:44 on May 23, remaining in the nest from 28 to 36 minutes on different occasions. The period of incubation is recorded as 12, 13½, and 14 days by different observers; about 13 seems to be the average, according to Dr. Walkinshaw (MS.), probably depending on conditions and the method of reckoning. Incubation seems to be performed entirely by the female, but the male feeds her to some extent while she is on the nest. Incubation starts the day before the last egg is laid.

Young.—Meyer and Nevius (1943) write:

> The adults shared feeding duties, and both removed fecal sacks. During the first three days the female steadily brooded the young. One female, observed from 4:55 to 8:10 a. m., when the young were one day old, spent a total of 70 minutes off and 155 minutes on the nest. Trips from the nest lasted an average of 8.6 minutes, while periods on the nest averaged 19.4 minutes. * * * At one nest when the young were eight days old, activities were noted during the eight and one-half hours from 8:30 a. m. to 5:30 p. m. The young were fed an average of 16 times an hour. * * * The adults were seen carrying spiders and insects, small green caterpillars frequently being used. Mr. H. P. Ijams saw a male offer a 10-day old nestling a mayfly. An incubator-hatched bird accepted egg-yolk, ants, ant larvae, crickets, earthworms, and spiders.

They say of the development of the young: "The young on the day of hatching had orange-red skin. The mouth lining was red. Down was distributed over the frontal and occipital areas of the capital tract, spinal tract, femoral, altar, and humeral tracts. Feather sheaths of the alar tracts penetrated the skin the first day after hatching. On the second day after hatching the eye-slits began to open. Feather sheaths of the humeral, femoral, and crural tracts emerged on the third day; those on the dorsal and ventral tracts emerged on the fourth day, and those of the capital and caudal tracts on the fifth day. On the fifth day the sheaths began breaking." During the next five days the young developed rapidly and became more and more active, and on the tenth day began to leave the nest.

Young observed by Dr. Walkinshaw (1914) at Reelfoot Lake "averaged 11 days of age when leaving the nest in 1939, while 21 young in Michigan during 1939 and 1940 remained in the nest for a period of 10¾ days." Of the comparative nesting success in the two localities, he says:

> In Michigan from 1930 through 1940, 121 nests of the Prothonotary Warbler were observed. Only 28, or 23.14 per cent, were successful. Out of 413 eggs, 159 (38.47 per cent) hatched and 100 young were fledged (.87 per total nest; 3.78 per successful nest). The fledgling success was 25.66 per cent of eggs laid. More failures in Michigan resulted in more nestings by individual birds.
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> In Tennessee during 1939, 30 nests were observed until terminated or successful; 19 were successful (63.33 per cent) while out of 139 eggs, 78 hatched and all the young lived to leave the nest or 56.11 per cent fledging success of eggs laid; 2.6 young were fledged per total nest; 4.1 per successful nest.

He also notes that in Michigan the species is typically single-brooded if the first nesting is successful, but that in Tennessee it is typically double-brooded.

Plumages.—According to Dr. Dwight (1900) the natal down, located as indicated above, is brownish mouse-gray. Ridgway (1902) gives rather the best description of the juvenal plumage as follows: "Pileum, hindneck, back, and scapulars dull olive-greenish; wing-coverts, tertials, rump, and upper tail-coverts slate-gray, tinged with olive, the middle and greater wing-coverts narrowly tipped with light olive-greenish, producing two very indistinct bands; secondaries, primaries, and rectrices as in adults; sides of head pale yellowish olive; chin, throat, and chest dull light grayish olive, darkest on chest rest of under parts dull white, passing on sides and flanks into olive-grayish."

In very young birds, according to Dr. Dwight, there is a variable amount of brownish wash on the back, which fades out to gray. And Dr. Chapman (1907) says that the white on the inner webs of the tail feathers is more restricted than in adults and more or less mottled with blackish. This first plumage is followed in June and July by a partial postjuvenal molt involving all the contour plumage and the wing coverts but not the rest of the wings or the tail. The young bird now becomes a golden swamp warbler, the young being nearly like the adults, the females being considerably duller in color than the males and having less white in the tail.

The crown and hind neck in both sexes, both old and young, are washed with dusky or olive in the fall. Spring plumages are produced by very slight wear without molt. There is one complete, annual molt in late summer.

Food.—Very little seems to have been recorded on the food of the prothonotary warbler. It is evidently highly insectivorous, obtaining most of its food from the trunks and branches of trees and shrubs and from fallen logs. Brewster (1878) says: "This Warbler usually seeks its food low down among thickets, moss-grown logs, or floating débris, and always about water. Sometimes it ascends tree-trunks for a little way like the Black-and-White Creeper, winding about with the same peculiar motion."

Dr. Roberts (1936) lists "ants, and other insects and their larvae," as its food. Some of the food of the young is mentioned above, most of which is doubtless included in the food of the adults. Spiders, beetles, mayflies, and other insects should be included, as well as many caterpillars and the larvae of water insects. Audubon (1841) says: "It often perches upon the rank grasses and water plants, in quest of minute molluscous animals which creep upon them, and which, together with small land snails, I have found in its stomach."

Behavior.—Brewster (1878a) observes:

> When seen among the upper branches, where it often goes to plume its feathers and sing in the warm sunshine, it almost invariably sits nearly motionless. Its flight is much like that of the Water-Thrush (either species), and is remarkably swift, firm, and decided. When crossing a broad stream it is slightly undulating, though always direct. * * *
>
> In general activity and restlessness few birds equal the species under consideration. Not a nook or corner of his domain but is repeatedly visited through the day. Now he sings a few times from the top of some tall willow that leans out over the stream, sitting motionless among the yellowish foliage, fully aware, perhaps, of the protection afforded by its harmonizing tints. The next moment he descends to the cool shades beneath, where dark, coffee-colored water, the overflow of the pond or river, stretches back among the trees. Here he loves to hop about on floating drift-wood, wet by the lapping of pulsating wavelets; now following up some long, inclining, half-submerged log, peeping into every crevice and occasionally dragging forth from its concealment a spider or small beetle, turning alternately his bright yellow breast and olive back towards the light; now jetting his beautiful tail or quivering his wings tremulously, he darts off into some thicket in response to a call from his mate; or, flying to a neighboring tree-trunk, clings for a moment against the mossy bole to pipe his little strain or look up the exact whereabouts of some suspected insect prize.

Voice.—The same gifted writer and careful observer (Brewster, 1878) gives the following good account of the distinctive song of this warbler:

> The usual song of the Prothonotary Warbler sounds at a distance like the call of the Solitary Sandpiper, with a syllable or two added,—a simple *peet, tweet, tweet, tweet,* given on the same key throughout. Often when the notes came

> from the farther shore of a river or pond we were completely deceived. On more than one occasion, when a good opportunity for comparison was offered by the actual presence of both birds at the same time, we found that at the distance of several hundred yards their notes were absolutely undistinguishable; nearer at hand, however, the resemblance is lost, and a ringing, penetrating quality becomes apparent in the Warbler's song. It now sounds like *peet, tsweet, tsweet, tsweet*, or sometimes *tweet, tr-sweet, tr-sweet, tr-sweet*. When the bird sings within a few yards the sound is almost startling in its intensity, and the listener feels inclined to stop his ears. The male is a fitful singer, and is quite as apt to be heard in the hot noontide or on cloudy days, when other birds are silent, as during the cool morning and evening hours. The ordinary note of alarm or distress is a sharp one, so nearly like that of the Large-billed Water Thrush (*Siurus motacilla*) that the slight difference can only be detected by a critical ear. When the sexes meet a soft *tchip* of recognition common to nearly all the Warblers is used. In addition to the song above described the male has a different and far sweeter one, which is reserved for select occasions,—an outpouring of the bird's most tender feelings, intended for the ears of his mate alone, like the rare evening warble of the Oven-Bird (*Siurus auricapillus*). It is apparently uttered only while on the wing.
>
> Although so low and feeble as to be inaudible many rods away, it is very sweet, resembling somewhat the song of the Canary, given in an undertone, with trills or "water-notes" interspersed. The flight during its delivery is very different from that at all other times. The bird progresses slowly, with a trembling, fluttering motion, its head raised and tail expanded. This song was heard most frequently after incubation had begun.

Dr. Roberts (1936) refers to this flight song, as delivered "after the manner of the Maryland Yellow-throat, * * * consisting first of the usual rapid monotone of five or six notes and ending with a pleasing, varied warble, full and strong in some of its notes and far sweeter than the usual utterance."

Dr. Walkinshaw (1938) says of the usual song: "Uttered at the rate of five or six times per minute, the song lasts slightly over one second. It is given all day long from the time of arrival until the young have left the nest and has been heard as late as the 16th of August (1931). The frequency is much greater during the early nesting season and during the earlier hours. During midday on warmer days the number of times per hour seems much less. Later, from four until near sundown, it again increases. During late nesting, when the young are about to leave the nest, the rate again decreases, but it is heard several days after the young leave the nest." Aretas A. Saunders tells me that the songs are pitched at C′′′′ or B′′′, and the call note, *tseek*, at A′′′.

Field marks.—The golden swamp warbler could hardly be mistaken for anything else. The rich, brilliant yellow of the head and breast, sometimes almost orange on the head, only slightly paler in the female, the absence of wing bars, and the large amount of white in the tail will distinguish it.

Enemies.—Dr. Walkinshaw (1941) says that the house wren is a serious competitor with the prothonotary warbler in Michigan, contending with it for nesting sites in the bird-boxes.

The cowbird is a persistent enemy of this warbler in spite of its hole-nesting habits; perhaps if the warbler nested in deeper holes it might find some relief from this pest. Among 70 sets of eggs of this warbler in the J. P. Norris collection, 18 contain cowbirds' eggs. Dr. Friedmann (1929) found no less than 36 records of such parasitism in the literature, and says: "As many as four eggs of the Cowbird have been found in a single nest together with four of the Warbler's. There are several cases on record of doubled-storied nests of this bird, with a Cowbird's egg buried in the lower story. Such cases are, however, not common, and usually the Warbler seems to make no attempt to get rid of the strange eggs." E. M. S. Dale wrote to me of a nest, found near Toronto in 1933, that contained seven eggs of the cowbird and none at all of the warbler!

Snakes sometimes destroy the eggs or young.

Fall.—Dr. Walkinshaw (1938) says that "the majority of the Prothonotaries leave our rivers [Michigan] by the second or third of July. One may canoe some years a good many miles during the latter part of July or the early part of August without finding a single Prothonotary, whereas in other years many groups can be found. The majority evidently are early migrants. Very few remain until late August or early September, the latest date being September 9, 1934, at Battle Creek."

The 1931 A. O. U. Check-List states that this warbler apparently crosses the Gulf of Mexico in migration "and is not found in Mexico north of Campeche," but probably some migration is along the coast of Texas and Mexico, as suggested by George G. Williams (1945).

Dr. Chapman (1907) says: "The route of the Prothonotary Warbler in its fall migration is interesting; the breeding birds of the Middle Atlantic States apparently pass southwest to northwestern Florida and then take a seven-hundred-mile flight directly across the Gulf of Mexico to southern Yucatan, instead of crossing to Cuba and thence to Yucatan."

Alexander F. Skutch writes to me: "Unrecorded from Guatemala, the prothonotary warbler is a rare bird of passage and very rare winter resident in the more southerly portions of Central America. When Carriker published his list of Costa Rican birds in 1910, he had a few records from the highlands—apparently of migrating birds—and from the Pacific lowlands, but none from Caribbean lowlands. But on March 4, 1934, I found it not uncommon at Puerto Limón, where I saw one among the royal palms in Vargas Park, and several among the shrubbery about the outlying cottages, all within a hundred yards of the Caribbean Sea. It has been recorded a number of times from the Canal Zone, but it is not common there. It is almost always seen in the vicinity of water."

Winter.—Apparently the main winter range is in Colombia and perhaps Venezuela. Referring to Magdalena, Colombia, P. J. Darlington, Jr. (1931), writes: "The Prothonotary Warbler swarms during the winter in the mangroves at Sevillano and in the fresh swamps at Cienaga. It was seen also in bushes on the sea beach at Donjaca September 15, and along the Rio Frio River in the edge of the foothills, where it was especially common in February. The birds usually occur near water, but numbers were noted again and again in yellow-flowering, acacia-like trees on the border of stump land and dry forest, far from water."

DISTRIBUTION

Range.—Eastern United States to northwestern South America.

Breeding range.—The prothonotary warbler breeds **north** to southeastern Minnesota (Cambridge, Lake Pekin, and La Crescent); central Wisconsin (New London and Shiocton); southern Michigan (Hesperia, Lansing, and Ann Arbor); northern Ohio (Toledo and Cleveland); extreme southern Ontario (Rondeau); western New York (Buffalo and Oak Orchard); northern West Virginia (Parkersburg); central Maryland (Seneca and Bowie); and southern Delaware (Gumboro). **East** to southern Delaware (Gumboro); eastern Virginia (Dyke, near Alexandria, and Dismal Swamp); and the Atlantic coast to central Florida (Lake Gentry and Padgett Creek). **South** to central Florida (Padgett Creek and possibly Puntarossa); the Gulf coast to southeastern Texas (Cove, Houston, and Bloomington). **West** to central Texas (Bloomington, Fort Worth, and Gainesville); central Oklahoma (Norman and Oklahoma City); eastern Kansas (Emporia and Manhattan); northwestern Iowa (Lake Okoboji); and southeastern Minnesota (Rochester, Red Wing, and Cambridge).

The prothonotary warbler has been recorded as casual or accidental **west** to southeastern Nebraska (Powell and Lincoln); southeastern South Dakota (Yankton and Sioux Falls); and central Minnesota (Brainerd). **North** to southern Ontario (London and Hamilton); central New York (Ithaca); Massachusetts (Northampton, Amherst, and Concord); New Hampshire (Concord); and Maine (Matinicus Island and Calais).

Winter range.—The winter home of the prothonotary warbler is in Central America and northwestern South America where it has been found **north** to northwestern Costa Rica (Bolson); Nicaragua (Escondido River). **East** to northwestern Venezuela (Mérida and Encontrados); and western Colombia (San José de Cucuta and Villavieja). **South** to southwestern Colombia (Villavieja); and northwestern Ecuador (Esmeraldas). **West** to northwestern Ecuador (Esmeraldas); western Colombia (Antioquia); western Panamá (Paracote and David); and Costa Rica (Puntarenas and Bolson). It has been reported to occur in winter in Campeche and on Cozumel Island, Mexico, and casually or accidentally in Cuba (Habana), Jamaica, and St. Croix, Virgin Islands.

Migration.—The probable route of the prothonotary warbler between its summer and winter homes is across the Gulf of Mexico, from the Yucatan peninsula where it occurs in both spring and fall migration. The casual or accidental occurrences of this warbler in Cuba (Habana); Jamaica; and St. Croix, Virgin Islands, are in migration.

Late dates of spring departure are: Colombia—Villavieja, February 5. Panamá; Canal Zone—Barro Colorado, March 10. Nicaragua—Edén, March 23. Quintana Roo—Cozumel, April 6. Cuba—Habana, April 4.

Early dates of spring arrival are: Yucatán—Mérida, March 28. Jamaica—Black River, February 28. Cuba—Habana, March 31. Florida—Pensacola, March 18. Alabama—Booth, April 4. Georgia—Fitzgerald, March 21. South Carolina—Yemassee, March 27. North Carolina—Greenville, April 6. Virginia—Suffolk, April 10. Mississippi—Gulfport, March 18. Louisiana—Morgan City, March 10. Texas—Cove, March 28. Arkansas—Huttig, March 31. Missouri—St. Louis, April 17. Kentucky—Bowling Green, April 5. Illinois—Murphysboro, April 17. Ohio—Berlin Center, April 18. Michigan—Grand Rapids, May 3. Iowa—Iowa City, April 26. Wisconsin—Madison, May 2. Minnesota—Red Wing, May 7. Oklahoma—Tulsa, April 2. Kansas—Manhattan, April 26. Nebraska—Blue Springs, April 30.

Late dates of fall departure are: Nebraska—Watson, September 1. Oklahoma—Oklahoma City, September 14. Texas—Kemah, September 11. Wisconsin—Racine, September 22. Iowa—Sioux City, August 31. Michigan—Three Rivers, September 13. Ohio—Columbus, October 5. Illinois—Oak Park, October 17. Kentucky—Lexington, October 6. Tennessee—Elizabethton, October 19. Louisiana—Monroe, October 8. Mississippi—Deer Island, September 27. North Carolina—Raleigh, August 26. South Carolina—Charleston, September 17. Georgia—Atlanta, October 8. Yucatán—Chichén-Itzá, October 18.

Early dates of fall arrival are: Florida—Fort Myers, August 8. Yucatán—Chichén-Itzá, October 7. Honduras—Tela, September 8.

Nicaragua—Río Escondido, September 2. Costa Rica—Bonilla, August 28. Panamá—Obaldia, September 15. Colombia—Gaira, September 11.

Banding records.—Banding provides a hint as to the life-span of the prothonotary warbler. One banded as an immature on June 16, 1940, in Convis township, Calhoun County, Mich., was color banded when it returned to the same place in 1942. Subsequently it was identified by the colored band on May 14, 1944, and May 10, 1945.

Casual records.—The prothonotary warbler was reported at Nassau, Bahamas, on August 29, 1898. It has been twice reported at Bermuda: one shot from a flock in the fall of 1874, and another specimen collected in November 1903. A single bird was observed at Mammoth Hot Springs, Yellowstone Park, Wyo., on September 10, 1931. There are two records for Arizona. On May 1, 1884, a specimen was taken near Tucson at an altitude of 2,300 feet, the highest record of the species in the United States. Another specimen was taken September 8, 1924, at Cave Creek, 4 miles northeast of Paradise in the Chiricahua Mountains.

Egg dates. Florida: 8 records, April 18 to May 9; 5 records, April 28 to 30.

Illinois: 79 records, May 6 to June 21; 46 records, May 20 to June 4, indicating the height of the season.

Iowa: 56 records, May 15 to June 26; 36 records, May 27 to June 6 (Harris).

LYMNOTHLYPIS SWAINSONII (Audubon)

SWAINSON'S WARBLER

Contributed by Edward von Siebold Dingle

Plates 7–9

HABITS

"The history of our knowledge of Swainson's Warbler," write Brooks and Legg (1942), "is a curious one, falling into definite periods." This bird was discovered in the spring of 1832 by the Rev. John Bachman "near the banks of the Edisto River, South Carolina." His discovery of the bird is described as follows: "I was first attracted by the novelty of its notes, four or five in number, repeated at intervals of five or six minutes apart. These notes were loud, clear, and more like a whistle than a song. They resembled the sounds of some extraordinary ventriloquist in such a degree, that I supposed the bird much farther from me than it really was; for after some trouble caused by these fictitious notes, I perceived it near to me and soon shot it" (Audubon, 1841). Dr. Bachman took five specimens; then, up to the spring of 1884, Swainson's warbler remained almost a lost species, for according to Brewster (1885a) there is no record of more than eight or nine birds being collected. Wayne, through collections and field work near Charleston, opened a productive 25-year period in the history of *swainsonii*, in which many valuable contributions were made by various observers. From 1910 to 1930 the name *swainsonii* was practically absent from the pages of current ornithological literature.

Brewster (1885a) has given us the best description of the bird's haunts in the low country:

> The particular kind of swamp to which he is most partial is known in local parlance as a "pine-land gall." It is usually a depression in the otherwise level surface, down which winds a brook, in places flowing swiftly between well-defined banks, in others divided into several sluggish channels or spreading about in stagnant pools, margined by a dense growth of cane, and covered with lily leaves or other aquatic vegetation. Its course through the open pine-lands is sharply marked by a belt of hardwood trees nourished to grand proportions by the rich soil and abundant moisture. Beneath, crumbling logs cumber the ground, while an under-growth of dogwood (*Cornus florida*), sassafras, viburnum, etc., is interlaced and made well-nigh impenetrable by a net-work of grapevines and greenbriar. These belts—river bottoms they are in miniature—rarely exceed a few rods in width; they may extend miles in a nearly straight line.

The writer has had a long acquaintance with Swainson's warbler in the low country of Carolina. Except during September (fall migration) the birds were almost never seen out of sight of substantial growths of cane, even when the nests were built in bushes, low trees, or vines. This has been the experience of practically all observers and, as Brooks and Legg (1942) remark, "an idée fixe among ornithologists" existed; the familiar description of habitat by Brewster (1885a) became a dictum: "Briefly, four things seem indispensible to his existence, viz., water, tangled thickets, patches of cane, and a rank growth of semi-aquatic plants."

Hence, the ornithological world received a surprise to learn that *swainsonii* was a summer resident and breeder in different localities of high altitude in the Appalachian Chain. Although several observers have found the bird nesting beyond the limits of the Coastal Plain, even in Piedmont territory, as La Prade (1922) did at 1,050 feet above sea level, it was E. A. Williams (1935) who first detected it in a truly mountainous terrain. During two successive summers he found birds near Tryon, N. C., "in open woods."

Loomis (1887) was quite prophetic when, in recording a Swainson's warbler from Chester, S. C., "in the heart of the Piedmont Region, one hundred and fifty miles from the coast," he wrote: "It awakens the mind to the possibility of an Up-Country habitat, yet awaiting discovery, where the true centre of abundance will finally be located."

The efforts of Brooks and Legg (1942) have shown Swainson's warbler to be a locally common summer resident in south-central West Virginia up to an elevation of 2,000 feet above sea level; no positive evidence of breeding has been found, but it undoubtedly does breed. In Tennessee, Wetmore (1939) has found the bird in mountainous country at 3,000 feet.

The question naturally arises, Did Swainson's warbler always inhabit higher altitudes, or is this a recent extension of range and partial change of habitat? The answer will probably never be found; but study of changing conditions in its low country habitat for the past several decades may throw light on this interesting problem. Within the writer's experience the canebrake areas have long been exposed to forest fires, timber cutting, overgrazing, drainage, and the construction of a hydroelectric project, as a result of which thousands of acres of timbered swampland are now under water.

Spring.—The birds that winter in Jamaica enter the United States through Florida, but it is probable that those from Yucatán make a direct flight across the Gulf to the delta of the Mississippi. The earliest recorded spring arrival in the United States was on March 22, 1890, on the lower Suwanee River. The same year the species was taken at the Tortugas, March 25 to April 5 (Chapman, 1907). The earliest arrival near New Orleans, was March 30, 1905 (Kopman, 1915). Meanley (MS.) records it from central Georgia on March 31, 1944. Swainson's warbler reaches the vicinity of Charleston, S. C., during the first week of April, the earliest being the fifth of that month.

Nesting.—Nests are built in bushes, canes, masses of vines, and briers; 10 feet seems to be the maximum height from the ground, while some nests have been found as low as 2 feet. The average elevation would be around 3 feet. As many nests are built over dry ground as over water. The nest is quite bulky and loosely constructed; a typical one in situ looks like a bunch of leaves lodged in a bush or cane, as the stems point upward. The outer walls of the nest are composed of various leaves such as oak, gum, maple, tupelo, and cane; the inner walls are usually of cane, while the lining is of pine needles, black fiber of moss (*Tillandsia*), cypress leaves, rootlets, or grass stems. Sometimes horsehair is also present.

[Author's Note: A few more notes on the nesting of Swainson's warbler may well be added to the above general statements. Brewster's (1885b) nests, taken by Wayne in the low country of South Carolina, are evidently typical for that region. All four of these nests were in canes. Wayne (1886) says that the nests "are generally built in canes," but he has also found them "in small bushes, and in one instance in a climbing vine, by the side of a large public road." Brewster (1885b) gives the measurements of two of his nests; the smallest of the four measures—

> externally 3.50 in diameter by 3.00 in depth; internally 1.50 in diameter by 1.50 in depth; the greatest thickness of the rim or outer wall being 1.00. * * *

The nest June 27 is very much larger, in fact quite the largest specimen that I have seen, measuring externally 5.00 in diameter by 6.00 in depth; internally 1.50 in diameter by 1.25 in depth; with the rim in places 1.75 thick. It is shaped like an inverted cone, the apex extending down nearly to the point of junction of the numerous fascicled stems which surround and support its sides. Its total bulk fully equals the average nest of our Crow Blackbird, while it is not nearly as finished a specimen of bird architecture. Indeed it would be difficult to imagine anything ruder than its outer walls,—composed of mud-soaked leaves of the sweet gum, water oak, holly, and cane, thrown together into a loose mass, bristling with rough stems, and wholly devoid of symmetry or regularity of outline. The interior, however, lined with pine needles, moss fibre, black rootlets, and a little horse-hair, is not less smooth and rounded than in the other specimens.

Troup D. Perry (1887), with his friend George Noble, found no less than 24 nests near Savannah, Ga., in 1887; some of these were in gall or myrtle bushes and one was in a saw palmetto 2½ feet high. S. A. Grimes has sent us a photograph of a nest on the broad leaf of a saw palmetto (pl. 7). Albert J. Kirn (1918) says of the nesting sites of Swainson's warbler in Oklahoma: "A well shaded clump of trees in the woods, such a place as would suggest itself for a Wood Thrush, yet not exactly so, with considerable 'buck brush' undergrowth, but no grass or weeds is selected for a nesting site. In the top of this 'buck brush' usually about two feet high the nest is built; about half of the nests found were close to the river bank—the Little Caney River. All but two were built in the brushy undergrowth. These two were fastened to briers and slender brush and were higher up, 3.5 and 4 feet."

F. M. Jones wrote to Brooks and Legg (1942) of a nest found in southwestern Virginia: "This nest was in a very dense growth of rhododendron bushes close to a stream of water where the sunlight never penetrated. It was 5 ft. 6 in. up, built in the forks of a slender beech limb which grew across the top of a rhododendron bush (*R. maximum*) and partly supported by the top of the rhododendron. * * * The outside of the nest measured 7 in. wide by 5 in. deep and the inside 2 in. wide by 1$\frac{13}{16}$ in. deep."

It is evident, from the above and other similar accounts that, at higher elevations northward and westward, Swainson's warbler nests in bushes and vines where there are no canes to be found.]

Eggs.—Swainson's warbler usually lays three eggs; sets of four are rare and of five very rare. Although there are records of nests containing two incubated eggs or two young birds, these probably represent incomplete sets or cases where an egg or a nestling has been destroyed.

Eggs are quite globular, the two ends sometimes scarcely distinguishable; the shell is thick and has a distinct polish; the ground color is white with a bluish tinge; however, a set of three eggs in the writer's collection had a faint greenish tinge, while several observers describe sets of pale pink or buffy white.

Rarely, spotted eggs are found. Wayne (1910) says: "Spotted eggs are, however, very rare and I have found only four or five nests containing them." The only spotted egg the writer has found is in the set referred to above; of these, two are immaculate, while the third is "faintly though distinctly speckled around the larger end with reddish brown" (Dingle, 1926).

Brewster (1885b) describes a set collected by the late Arthur T. Wayne: "One is perfectly plain; another * * * has two or three minute specks which may be genuine shell markings; while the third is unmistakably spotted and blotched with pale lilac. Over most of the surface these markings are fine, faint, and sparsely distributed, but about the larger end they become coarser, thicker, and deeper colored, forming a well-defined ring or wreath."

Burleigh (1923) writes: "Unlike all the descriptions I had read, and the few eggs I had seen, these were light pink in ground color and dotted distinctly over the entire surface with light brown spots, this almost forming a wreath at the larger end of one egg." These eggs were found near Augusta, Ga., and the parent was secured.

Wayne (1910) was of the opinion that two broods are raised in a season.

[AUTHOR'S NOTE: The measurements of 50 eggs average 19.5 by 15.0 millimeters; the eggs showing the four extremes measure **21.6** by 14.2, 20.8 by **16.0, 18.0** by 14.1, and 19.5 by **13.5** millimeters (Harris).]

Plumages.—[AUTHOR'S NOTE: Ridgway (1902) describes the juvenal plumage of Swainson's warbler as follows: "Head, neck, back, rump, upper tail-coverts, chest, sides, and flanks plain brown (varying from broccoli to bister); rest of under parts whitish or dull pale yellowish, more or less clouded with brown; middle and greater wing-coverts indistinctly tipped with cinnamon-brown; otherwise like adults, but no trace of lighter superciliary nor darker postocular stripes." Specimens that I have seen in this plumage are more nearly "cinnamon-brown" than the colors named above on the back and wing coverts, and the latter show very little evidence of cinnamon tips.]

The postjuvenal molt, which evidently includes only the contour plumage and the wing coverts, occurs early in the summer; I have seen young birds beginning to acquire the first winter plumage as early as June 12, and others that had nearly completed the molt on July 20; these birds were not yet fully grown. Wayne (1910) writes: "I have taken young birds which were as large as the adults and which were acquiring their autumnal plumage as early as June 2, but it must be borne in mind that the season in which these young were taken (1906) was exceptionally advanced."

Brewster (1885a) describes the young bird in its fall plumage as follows: "Entire upper parts rich olive strongly tinged with reddish-brown, the crown scarcely deeper-colored than the back, the wings a trifle redder; loral stripe blackish; superciliary stripe tinged with yellow; under parts strongly yellowish, otherwise like the adult."

The nuptial plumage is apparently assumed by wear and fading, the reddish-brown and yellowish colors becoming much duller. There are no specimens available of either young or adult birds that indicate a prenuptial molt.

The postnuptial molt seems to occur mainly in August, but perhaps earlier, and is evidently complete; I have seen birds in full, fresh autumn plumage as early as August 28. This fresh plumage is similar to the spring plumage, but the crown and back are nearly uniform brown, the crown is darker than in spring, the back is browner than in spring, and the breast and flanks are more or less clouded with grayish.

Food.—Howell (1924) says that "four stomachs of this bird from Alabama contained remains of caterpillars, spiders, and Hymenoptera (ants, bees, etc.)."

Brewster (1885a) considered the principal food to be small coleopterous insects, "as well as some small green worms that are found on water plants, such as the pond lily (*Nymphaea odorata*) and the Nelumbium (*Cyamus flavicomus*).

Behavior.—Swainson's warbler is an unsuspicious bird and can be easily observed in its haunts where the vegetation is not too dense and tangled and the tree canopy overhead partially open. The neutral color of the bird is often apt to conceal him in the shadowy undergrowth. Singing males usually remain on the same perch during their periods of song, apparently disinclined to move. He often sings from the ground during insect hunting; Meanley (MS.) says: "It was so wrapped up in its song as to be absolutely unconcerned; it sang at my very feet with its head thrown back, its beak pointing perpendicularly toward the sky, pouring forth its resounding melody in the best of warbler fashion."

The female is a close sitter, and the observer has usually to touch her before she leaves the nest. Grimes (1936) writes: "This bird would not leave her eggs until *pushed* off, and when I held my hand over the nest she straddled my fingers in trying to get back onto it. * * * When I did drive her away from the nest she fluttered along on the ground in the manner of a crippled bird, her actions manifestly intended to induce me to follow. This bird certainly was not badly frightened, for within a few minutes she was back on her nest, accepting deerflies from my fingers and swallowing them with apparent relish."

Brewster (1885a) gives an admirable portrayal:

> His gait is distinctly a walk, his motions gliding and graceful. Upon alighting in the branches, after being flushed from the ground, he assumes a statuesque attitude, like that of a startled Thrush. While singing he takes an easier posture, but rarely moves on his perch. If desirous of changing his position he flies from branch to branch instead of hopping through the twigs in the manner of most Warblers. Under the influence of excitement or jealousy he sometimes jets his tail, droops his wings, and raises the feathers of the crown in a loose crest, but the tail is never jerked like that of a *Geothlypis*, or wagged like that of a *Siurus*. On the contrary, his movements are all deliberate and composed, his disposition sedentary and phlegmatic.

Voice.—The bird student who hears the song of Swainson's warbler as he sings in his wooded retreat is fortunate, for it is one of the outstanding warbler songs and, once heard, leaves a lasting impression upon the listener. At a distance it bears much resemblance to the songs of the hoooded warbler and the Louisiana waterthrush. Close up, however, the appealing quality, lacking in the other two, impresses the listener strongly. The song has, in the majority of individuals, a highly ventriloquial effect, but the writer has listened to birds whose notes did not in the slightest degree possess this quality.

The song varies in length and number of notes but can be separated into two distinct parts; the first few notes are uttered rather slowly, the last ones more rapidly and on a descending scale. The second part closely follows the first, with no apparent separation. Brooks and Legg (1942) write: "It might be translated as *whee, whee, whee, whip-poor-will*, the first two (or three) introductory notes on an even pitch, the last *whee* a half-tone lower, and the slurred phrase with *will* separated into two syllables, and accented on the *whip* and on the *wi*-part of the *will.* The last phrase sounded at times remarkably like one of the songs of the White-eyed Vireo."

When the singer begins his performance, the bill is pointed directly up, and he seems entirely unconscious of anything but his own musical efforts. "During his intervals of silence," says N. C. Brown (1878), "he remains motionless, with plumage ruffled, as if completely lost in musical reverie." Brewster (1885a) adds:

> It is very loud, very rich, very beautiful, while it has an indescribably tender quality that thrills the senses after the sound has ceased. * * * Although a rarely fervent and ecstatic songster, our litle friend is also a fitful and uncertain one. You may wait for hours near his retreat, even in early morning, or late afternoon, without hearing a note. But when the inspiration comes he floods the woods with music, one song often following another so quickly that there is scarce a pause for breath between. In this manner I have known him to sing for fully twenty minutes, although ordinarily the entire performance occupies less than half that time. Such outbursts may occur at almost any hour, even at noontide, and I have heard them in the gloomiest weather, when the woods were shrouded in mist and rain.

Several times the writer has seen males when the inspiration had not quite come to them; the bird would throw back its head but utter only one or two opening notes of his song.

The call note is a chip, which Brewster calls "a soft *tchip* indistinguishable from that of *Parula americana.*" But Murray (1935) writes that it is "more throaty and full-bodied than that of most Warblers." Brooks and Legg (1942) describe it as "clear, penetrating chirps, having (to our ears) much the same quality as do the chirps of the Mourning Warbler. They are not quite so loud, but have a more ringing quality than those of the Hooded Warbler."

Field marks.—[AUTHOR'S NOTE: Swainson's warbler is a plainly colored bird, with no conspicuous field marks. It is brownish olive above and whitish below, with no white in either wings or tail; there is a whitish line over the eye and a dusky streak through it; but the bill is long and sharply pointed.]

DISTRIBUTION

Range.—Southeastern United States to southern Mexico.

Breeding range.—Until about 1935 Swainson's warbler was considered to be confined in summer to the southern canebrakes and coastal marshes. It is now known to breed **north** to extreme southern Illinois, probably (seen in breeding season to Olive Branch, Duquoin, and Mount Carmel); southeastern Kentucky (Big Black Mountain); central to northern West Virginia (Charleston, Mount Lookout, Sutton, and Buzzard Rocks, Monongalia County); and southeastern Maryland (Pocomoke River Swamp). **East** to eastern Maryland (Pocomoke River Swamp); eastern Virginia (Warwick County and Dismal Swamp); eastern North Carolina (New Bern, Lake Ellis, and Red Springs); eastern South Carolina (Summerton, Charleston, and (Yemassee); eastern Georgia (Savannah and Okefinokee Swamp); and northeastern Florida (Jacksonville). **South** to northern Florida (Jacksonville, Oldtown, Whitfield, and Pensacola) and southern Louisiana (Mandeville, New Orleans, and Baton Rouge). **West** to eastern Louisiana (Baton Rouge, Bayou Sara, and Jena); central Arkansas (Camden and Conway); extreme northeastern Oklahoma (Copan); and central Missouri (Concordia).

Within this large breeding area are two almost discontinuous breeding ranges: the coastal and swamp range long considered the only home of the species; and the more recently discovered mountain home along the slopes of the Allegheny Mountains from northern West Virginia nearly to the Georgia line where it has been found to an altitude of nearly 3,000 feet.

Winter range.—The winter home of the Swainson's warbler is very imperfectly known from a dozen or more specimens, most of which are from Jamaica where it has been listed as a rare winter resident. There are records also from the Swan Islands (March 1); Santa Lucia, Quintana Roo; Pacaytain, Campeche; and the city of Veracruz. Two specimens have been taken near Habana, Cuba; one on September 25, the other in April; and one near Guantánamo on January 18, 1914.

Migration.—Dates of spring departure are: Jamaica, April 8. Cuba—Habana, April 14.

Early dates of spring arrival are: Florida—St. Petersburg, March 25. Alabama—Autaugaville, April 3. Georgia—Savannah, March 25. South Carolina, April 1. Louisiana—New Orleans, March 30. Mississippi—Biloxi, March 31. Tennessee—Memphis, April 20. Texas—Point Bolivar, April 17.

Late dates of fall departure are: Texas—Kemah, September 27. Tennessee—Sulphur Springs, September 9. Mississippi—Gulfport, October 6. South Carolina—Charleston, October 10. Georgia—Savannah, October 18. Alabama—Greensboro, September 6. Florida—Pensacola, October 2; Sombrero Key (4 struck lighthouse November 10).

Dates of fall arrival are: Tamaulipas—Matamoros, August 29. Jamaica, October 1.

Casual records.—A specimen was recorded near Corsicana, Tex., on August 24, 1880; another was collected at Kearney, Nebr., on April 9, 1905; and one near Holly, Prowers County, Colo., on May 12, 1913.

Egg dates.—Florida: 3 records, May 7. Georgia: 35 records, May 4 to July 13; 19 records, May 29 to June 17, indicating the height of the season. South Carolina: 28 records, May 2 to June 30; 14 records, May 12 to June 12 (Harris).

HELMITHEROS VERMIVOROS (Gmelin)

WORM-EATING WARBLER

PLATE 10

HABITS

The breeding range of the worm-eating warbler covers much of the central portion of the United States east of the prairie regions. Its center of abundance seems to be in the vicinity of Pennsylvania, but it breeds less abundantly northward to southern Iowa, New York, and New England and southward to Missouri and to northern Alabama and Georgia, as well as in much of the intervening wooded region, where it is essentially a woodland bird.

The distribution, migration, and habits of this warbler were but poorly understood by the early writers on American birds, and neither Wilson nor Audubon ever saw its nest; the latter's description of the nest, probably from hearsay, is entirely wrong. Frank L. Burns writes to me: "Bartram neglected to list this species, although he had furnished the type to Edwards 35 years earlier, and from the information furnished by the youthful Bartram it doubtless received its name, which is a misnomer perpetuated by Gmelin in his *Motacilla vermivora*." Mr. Burns says further on in his notes: "I searched for 10 seasons before I found my first nest, and oddly enough it was through the parent bird carrying a 'worm' to its young; nevertheless I have since thought that a more fitting name for the species would have been hillside or laurel warbler."

Hillside warbler would not be a bad name for this bird, which shows a decided preference for wooded hillsides covered with medium-sized deciduous trees and an undergrowth of saplings and small shrubbery. Often a running stream with numerous swampy places, overgrown with brier tangles and alders, bounds the base of the hill as an additional attraction. It is seldom seen outside of its favorite woods and returns year after year to the same chosen haunts.

W. E. Clyde Todd (1940) says that in western Pennsylvania "wooded slopes are its chosen abodes, the shadier and cooler the better. * * * Deep ravines, down which trickle little streams, and the slopes of which support good stands of deciduous trees, with plenty of shrubbery and bushes for cover, are favorite resorts." In Ritchie County, W. Va., William Brewster (1875) found it "most partial to the retired thickets in the woods along water courses, and seldom or never found in the high open groves."

Spring.—The northward movement of the worm-eating warbler evidently begins in March, as the earliest arrivals from the Bahamas, the West Indies, and Cuba reach southern Florida during the first week in April. From its main winter resorts in Central America the flight seems to be partially across the Gulf of Mexico. Professor Cooke (1904) says in part: "The time of arrival on the coasts of Louisiana and Texas is about the same as in southern Florida. * * * Houston is the southernmost point in Texas from which it has been recorded to date, and Alta Mira is the northernmost point of record in Mexico. Since the species is apparently not common west of Louisana or north of Vera Cruz, it is probable that the principal line of migration is from Yucatan and the coast immediately west of Yucatan directly north to the northern coast of the Gulf of Mexico." According to Williams (1945) the species is common on the coast of Texas in spring, and it probably migrates along the coast. Thence the migration proceeds northward through the Mississippi Valley and through the Atlantic Coast States east of the Alleghenies, the warblers reaching the more northern breeding grounds by the middle of May, where nesting activities begin as soon as mates have been selected.

Nesting.—Evidently Thomas H. Jackson, of West Chester, Pa., was the first to report the discovery of the nest of the worm-eating warbler; he published an account of it in the American Naturalist for December 1869, from which Baird, Brewer, and Ridgway (1874) quote as follows: "On the 6th of June, 1869, I found a nest of this species containing five eggs. It was placed in a hollow on the ground, much like the nests of the Oven-Bird (*Seiurus aurocapillus*), and was well hidden from sight by the dry leaves that lay thickly around. The nest was composed externally of dead leaves, mostly those of the beech, while the interior was prettily lined with the fine, thread-like stalks of the hair-moss (*Polytrichium*). * * * So close did the female sit that I captured her without difficulty by placing my hat over the nest."

This nest was quite characteristic of the species. Mr. Burns writes to me: "The nest, well hidden under a drift of dead forest leaves, never varied in composition in over a hundred examples examined by me, in partly skeletonized leaves and the characteristic reddish-brown lining of the flower stem of the hair moss." Every one of 50 nests found by Mr. Jackson was lined with these flower stems, and out of 34 nests reported by Dr. Samuel S. Dickey (1934) only one failed to contain this material, being lined with "black and gray horsehair." Samuel B. Ladd (1887) says that "sometimes fine grass and horse-hair are used as part of the lining." Dr. Chapman (1907) writes: "Nests taken by J. N. Clark at Saybrook, Connecticut (C. W. C.) are composed of decayed leaves and lined with stems of maple seeds." And there are probably a few other exceptions to the rule.

Most observers agree that the worm-eating warbler prefers to nest on hillsides, either sloping or steep, but a number of nests have been found on the sides of deep, shady ravines, or on steep banks. Mr. Ladd (1887), however, states: "I have observed that these birds are not confined necessarily to hill-sides, as was heretofore supposed, as I have taken three sets on level ground and in rather open places, with little shade. The experience of Mr. Thomas H. Jackson of this place, who has taken ten nests this year, corroborates this fact."

The nests are generally well concealed under a canopy of dead leaves, drifted by the wind and lodged against a maple, beech, dogwood, or ash sapling, or under hydrangea, laurel, or rhododendron bushes, or under some bunch of weeds or other obstruction. They are sometimes concealed under the roots of a tree or in a cavity in a bank where they are protected somewhat by fallen leaves.

Eggs.—The number of eggs laid by the worm-eating warbler varies from 3 to 6, but the set usually consists of 4 or 5. The eggs are ovate or short ovate, sometimes rather pointed, and only slightly glossy. The white ground color is speckled and spotted with shades of "russet," "vinaceous russet," and "auburn," intermingled with "light brownish drab" and "light vinaceous-drab." The markings, usually more thickly grouped at the large end, vary considerably, some eggs being boldly marked, while others are almost immaculate, or have just a few pale freckles of "light brownish drab" and "fawn." The measurements of 50 eggs average 17.4 by 13.6 millimeters; the eggs showing the four extremes measure 20.8 by 14.5, and 15.5 by 12.7 millimeters (Harris).

Incubation.—Frank L. Burns (1905) writes:

> Incubation does not always commence immediately after completion of set, particularly if the season be young. It is probable that the second night witnesses the beginning of that period and, as far as my experience goes, I believe it is performed by the female alone. The male feeds her when covering newly hatched young.
>
> The home-coming of a brooding bird, after a brief airing and feeding, is heralded several hundred yards distant by frequent *chips* and short flights from branch to branch near the ground, in leisurely fashion and circuitous route, until at length, arriving above the nest, she runs down a sapling and is silent. The bird is a close sitter and if approached from the open front will often allow a few minutes' silent inspection, eye to eye, at arm's length, sometimes not vacating until touched, then she runs off in a sinuous trail, not always feigning lameness before the young are out. When disturbed with young in the nest she will flutter off with open wings and tail, and, failing to lead one off, will return with her mate, who is seldom far off at this period, circling about the nest or intruder, and, if the young are well feathered, she will dash at them, forcing them from the nest and to shelter. Once this brave little bird dashed at me and ran up to my knee, scratching with her sharp little claws at every step. On the return the birds always make the vicinity ring with their protests—a quickly repeated *chip*. The period of incubation in one instance was thirteen days.

Young.—Mr. Burns continues:

> Young fear man soon after their eyes are open, and a menacing finger will cause them to scamper out and away, repeated replacing in the nest proving of no avail after they became panic-stricken. At three days of age they made no outcry but opened their mouths for food, which consisted of a species of white moth, or "miller," and soft white grubs, supplied by either of the parent birds. At that period they were naked except a fluff on head and wing quills, just showing feathers at tips. In the presence of an intruder and absence of the parents, they will sit motionless if not threatened, and, but for the blinking, beady eyes, one might mistake them when well fledged, at very close range, for dead leaves. The head stripes became visible under the nestling down on the seventh day, and they left the nest ten days after leaving the shell, in the one case I have kept record of. The parents keep the young together for several days at least, just how long is impossible to say. One brood is all that is reared in a season, I think.

Plumages.—Dr. Dwight (1900) calls the natal down "brownish mouse-gray," and describes the juvenal plumage as follows: "Whole body plumage and the wing coverts cinnamon, palest on the abdomen. Wings and tail olive-brown edged with olive-green. Two indistinct lateral crown stripes brownish mouse-gray. A transocular streak dusky." Ridgway's (1902) description is somewhat different: "Head, neck, and under parts buff, the pileum with two broad, but strongly contrasted, lateral stripes of wood brown or isabella color; a postocular streak of the same color; back, scapulars, rump, and upper tail-coverts wood brown or isabella color; wing-coverts light buffy olive, the middle and greater broadly but not sharply tipped with cinnamon-buff; remiges and rectrices grayish olive-green, as in adults." Young birds seem to vary considerably in the color of the upper parts.

A partial postjuvenal molt occurring in late June or early July involves all the contour plumage and the wing coverts but not the rest of the wings or the tail. The young bird in its first winter plumage is practically indistinguishable from the adult at that season, except for the juvenal wings, in which the tertials are lightly tipped with rusty brown.

There is apparently no spring molt, but a complete postnuptial molt occurs in July. Spring birds are slightly paler, grayer and less buffy than in the fall. The sexes are practically alike in all plumages.

Food.—As I have said, the name worm-eating warbler seems to be somewhat of a misnomer for this bird. Edward H. Forbush (1929) writes: "I find no records of any consumption of earthworms by this species, which although a typical ground warbler spends some of its time hunting among the branches of trees, where it finds span-worms. It also hunts on the ground in damp places frequented by army-worms. Nevertheless these are not worms but caterpillars. Probably, however, in its perambulations and peregrinations upon the surface of the earth the bird now and then does pick up a small earthworm, for earthworms form a staple food for many birds when the ground is moist."

Arthur H. Howell (1924) says: "Little is known of the food of this species, but it seems doubtful whether it lives up to its name of 'worm-eater.' Two stomachs of this bird from Alabama contained remains of weevils, beetles, bugs, caterpillars, and Hymenoptera." Howell (1932) further reports: "The stomachs of three individuals taken in Florida in April contained small grasshoppers, caterpillars, sawfly larvae, beetles, and spiders. One dragon-fly, one bumblebee, and one 'walking stick' were also included in the contents." Professor Aughey (1878) included the worm-eating warbler among the birds seen catching locusts in Nebraska.

Behavior.—Brewster (1875) gives the best account of the activities of the worm-eating warbler as follows:

> They keep much on the ground, where they *walk* about rather slowly, searching for their food among the dried leaves. In general appearance they are quite unique, and I rarely failed to identify one with an instant's glance, so very peculiar are all their attitudes and motions. The tail is habitually carried at an elevation considerably above the line of the back, which gives them a smart, jaunty air, and if the dorsal aspect be exposed, in a clear light, the peculiar marking of the crown is quite conspicuous. Seen as they usually are, however, dimly flitting ahead through the gloom and shadow of the thickets, the impression received is that of a dark little bird which vanishes unaccountably before your very eyes, leaving you quite uncertain where to look for it next; indeed, I hardly know a more difficult bird to procure, for the slightest noise sends it darting off through the woods at once. Occasionally you will come upon one winding around the trunk of some small tree exactly in the manner of *Mniotilta varia*, moving out along the branches with nimble motion, peering alternately under the bark on either side, and anon returning to the main stem, perhaps in the next instant to hop back to the ground again. On such occasions they rarely ascend to the height of more than eight or ten feet. The males are very quarrelsome, chasing one another through the woods with loud, sharp chirpings, careering with almost inconceivable velocity up among the tops of the highest oaks, or darting among the thickets with interminable doublings until the pursuer, growing tired of the chase, alights on some low twig or old mossy log, and in token of his victory, utters a warble so feeble that you must be very near to catch it at all, a sound like that produced by striking two pebbles very quickly and gently together, or the song of *Spizella socialis* heard at a distance, and altogether a very indifferent performance.

Voice.—Aretas A. Saunders has contributed the following study of the song of this warbler:

> The song of the worm-eating warbler is a simple trill, varying from 1⅗ to 2⅕ seconds in length. It is usually all on the same pitch, but a few songs rise or fall a half tone, and one record I have rises a full tone and then drops a half tone at the end. The quality is not musical, but rather closely resembles some forms of the chipping sparrow's song. The pitch varies from G sharp''' to F sharp'''', one tone less than an octave.
>
> The majority of songs are a continuous trill, that is, the notes are too fast to be separated and counted by ear. I have three examples that are broken into short, very rapid notes. Two of these were of 18 notes and one was of 28. Most of the songs vary in loudness, becoming loudest in the middle, or beginning loud and fading away toward the end. One record becomes louder toward the end and ends abruptly.

Francis H. Allen describes in his notes a song "remarkably like that of the chipping sparrow, but more rapid than is usual with that species, I think, and perhaps shorter, though not so short as the chippy's early-morning song. The bill quivers with the song, but does not close between the *chips*. The bird sang constantly as it flitted about, usually 10 or 20 feet from the ground, seeming to prefer dead branches and twigs."

Almost everyone emphasizes the resemblance of the song to that of the chipping sparrow. Burns (1905) says: "I can distinguish no difference between the notes of this species and the Chipping Sparrow; the first may be a trifle weaker perhaps." But, in some notes recently sent to me, he writes: "The song has often been described as easily mistaken for that of either the chipping sparrow or slate-colored junco, but by no means by an expert. The notes of the worm-eater have a buzzing or bubbling quality not easily described, but are quite distinct from the flat notes of the species named above." And Eugene P. Bicknell (1884) writes: "The songs of no other three birds known to me are more alike than those of the Worm-eating Warbler, the Chipping Sparrow, and the Slate-colored Snowbird." He is in agreement with Saunders and Burns that this bird sings from the time of its arrival until the last of June or early July, but he also says: "On July 10, 1881, several of these birds were silently inhabiting a small tract of woodland, their first season of song having passed; here, on August 14, and again on the 21st, they were found in fine plumage and in full song." Evidently there is a cessation of singing during the molting period.

Burns (1905) says of the song: "The series of notes may be uttered while perched, or creeping about the lower branches of the trees, sapling tops, bushes or fallen brush, or while on the ground. With slightly drooping tail and wings, puffing out of body plumage, throwing its head back until the beak is perpendicular, it trills with swelling throat an unvarying *Che-e-e-e-e-e-e*, which does not sound half so monotonous in the woods as does the Chippy's lay in the open."

Dr. Chapman (1907) adds: "Mr. W. DeW. Miller of Plainfield, New Jersey, tells me that he has on two occasions heard a flight song from this species. It is described by him as much more varied and musical than the ordinary song, though lacking in strength. It was given as the bird flew through the woods at an even level, not rising above the tree-tops, as does the Oven-bird and other flight singers."

Field marks.—When seen walking around on the ground the worm-eating warbler might be mistaken for an ovenbird, but the conspicuous black stripes on the head of the former are quite distinctive, very different from the head markings of the latter. Moreover, the ovenbird is distinctly spotted on the breast, whereas the warbler has a plain, unmarked breast and no conspicuous wing bars. Except for the bold stripes on the head it is just a plain olive and buffy warbler in all plumages.

Enemies.—Says Burns (1905): "This Warbler's enemies are wood-mice, red squirrels and hunting dogs; the latter will sometimes push up and overturn the nest; an occasional weasel or blacksnake may destroy a few young. The percentage of loss while in the nest cannot be high."

Friedmann (1929) regards the worm-eating warbler as a "rather uncommonly imposed upon species" by the eastern cowbird. "Twenty-one definite records, and as many more indefinite ones have come to my notice."

Winter.—Dr. Alexander F. Skutch contributes the following: "Widely distributed as a winter resident in Central America, the worm-eating warbler appears to be everywhere very rare. It occurs from Guatemala to Panamá on both coasts, and upward in the mountains to at least 5,000 feet. On February 26, 1935, I found one in the forest on Barro Colorado Island, Canal Zone, which appears to represent a slight southward extension of the known range. I have recorded this rare visitant from every part of Central America below 6,000 feet in which I have made an extended sojourn during the months of the northern winter, yet only one or two in each locality, except on the Finca Mocá on the Pacific slope of Guatemala at 3,000 feet above sea-level, where in one day—January 21, 1935—I saw three. The worm-eating warbler is found in the Tropics beneath dense thickets or in the undergrowth of the forest, usually near the ground; but at times one will rise to the lower branches of the trees to investigate curled dead leaves caught up among them. It is solitary rather than social in its habits.

"The records of the occurrence of this warbler in Central America are too few to indicate clearly the dates of its arrival and departure. I found one at Tela, Honduras, on August 19, 1930; but the next early record is for October 14, at the same locality. Griscom quotes a record by Dearborn for the occurrence of this warbler at Patulul, Guatemala, on April 2; but except for this, the latest record I have seen is from El General, Costa Rica, March 11, 1939."

DISTRIBUTION

Range.—Eastern United States to Panamá.

Breeding range.—The worm-eating warbler breeds **north** to northeastern Kansas (Lawrence); possibly central southern Nebraska (Red Cloud); probably south-central Iowa (Des Moines); probably southern Wisconsin (Wyalusing, Madison, and Milwaukee); northeastern Illinois (Hinsdale); southern Indiana (Terre Haute, Bloomington, and Indianapolis); central Ohio (Columbus, East Liverpool, and possibly Cleveland); southern New York (Penn Yan and Albany), and southern Connecticut (New Haven and Saybrook). It has been found in summer north to London, Ontario; Northampton, Ipswich, and North Eastham, Massachusetts. **East** to Connecticut (Saybrook); Long Island (Newtown); northern New Jersey (Elizabeth and Morristown); eastern Pennsylvania (Norristown and Philadelphia); northern Delaware (Wilmington); central Maryland (Baltimore; rarely east of Chesapeake Bay); eastern Virginia (Cobham and Dismal Swamp); central North Carolina (Chapel Hill and Statesville); northwestern South Carolina (Caesars Head, Mount Pinnacle, and Sassafras Mountain); and northern Georgia (Brasstown Bald and Atlanta). **South** to northern Georgia (Atlanta); central Tennessee (Nashville and Wildersville); northern Arkansas (Newport and Winslow); and, occasionally, extreme northern Texas (Bowie County and Gainesville). **West** to northern Texas (Gainesville); northeastern Oklahoma (Jay); and eastern Kansas (Lawrence). It has been recorded in summer, but with no evidence of breeding, at Red Cloud, Nebr., and at London and Vineland Station, Ontario.

Winter range.—In winter the worm-eating warbler is found **north** to southern Tamaulipas (Altamira); northern Florida, casually (Blue Springs and Amelia Island), and the Bahamas (Abaco, Nassau, and Great Inago). **East** to the Bahamas (Great Inago); Jamaica and central Panamá (Río Chepo). **South** to Panamá (Río Chepo, Barro Colorado, and Chiriquí). **West** to western Panamá (Chiriquí); Costa Rica (Escasú and Volcán Tonorio); El Salvador (Mount Cacaguatique); Guatemala (Dueñas, Patulul, and Naranjo); southern Chiapas (Huehuetan); western Veracruz (Jalapa); Hidalgo (Pachuca); and southern Tamaulipas (Altamira).

Migration.—Late dates of spring departure are: Panamá—Darién March 16. Costa Rica—El General, March 19. El Salvador—Barra de Santiago, April 8. Guatemala—Patulul, April 2. Yucatán—Mérida, April 9. Cuba—Habana, May 1. Bahamas—Abaco, April 29. Florida—Seven Oaks, May 14. Georgia—Cumberland, May 7. Alabama—Barachias, May 1. Mississippi—Biloxi, April 27. Louisiana—Avery Island, April 23.

Early dates of spring arrival are: Florida—Pensacola, March 26. Georgia—Savannah, April 4. South Carolina—Mount Pleasant, April 7. North Carolina—Bat Cave, April 16. Virginia—Richmond, April 19. West Virginia—Morgantown, April 4. District of Columbia—Washington, April 21. Pennsylvania—Beaver, April 29. New York—Jones Beach, April 20. Louisiana—Grand Isle, April 3. Mississippi—Bay St. Louis, April 5. Tennessee—Chattanooga, April 15. Kentucky—Bowling Green, April 3. Indiana—Brookville, April 17. Ohio—Columbus, April 18. Texas—Brownsville, March 29. Missouri—St. Louis, April 15. Iowa—Keokuk, April 21.

Late dates of fall departure are: Missouri—St. Louis, September 20. Ohio—Austinburg, September 23. Kentucky—Middlesboro, September 27. Tennessee—Athens, October 5. Mississippi—Biloxi, October 11. Louisiana—Monroe, September 30. New York—Balston, September 23. Pennsylvania—Atglen, October 10. District of Columbia—Washington, September 13. West Virginia—Bluefield, September 19. Virginia—Salem, October 24. North Carolina—Andrews, October 11; Raleigh, November 3. South Carolina—Charleston, October 11. Georgia—Atlanta, October 10. Florida—Fernandina, October 3.

Casual records.—A specimen was collected in Bermuda on October 4, 1899. An individual was present at Wood Pond near Jackson, Somerset County, Maine, September 1 to 12, 1935; and one was reported seen at Mayagüez, Puerto Rico, on October 15, 1943, following a small hurricane.

Egg dates.—Connecticut: 7 records, May 27 to June 29.

New Jersey: 4 records, May 21 to 30.

Pennsylvania: 75 records, May 15 to June 30: 45 records, May 24 to June 5, indicating the height of the season (Harris).

VERMIVORA CHRYSOPTERA (Linnaeus)

GOLDEN-WINGED WARBLER

PLATES 10, 11

CONTRIBUTED BY WINSOR MARRETT TYLER

HABITS

The golden-winged warbler is one of the daintiest among this group of gay-colored little birds. Its plumage is immaculate white below and delicate pearl-gray on the upper parts, the crown and wings sparkle with golden yellow, and on the throat and cheeks is a broad splash of jet black.

It is only within comparatively recent years that we have become well acquainted with the goldenwing: the older ornithologists, Wilson, Audubon, and Nuttall, knew it only as a rather uncommon migrant, drifting through from the south, and they had no idea where it bred. At a much later date J. A. Allen (1870) says of it: "This beautiful warbler has been taken, so far as I can learn, but few times in the western part of the State; it seems to be more common in the eastern, where it breeds." He cites the first record of the finding of a nest in the State in 1869. There is, however, an earlier record of its nesting. Dr. Brewer (1874) states: "Dr. Samuel Cabot was the first naturalist to meet with the nest and eggs of this bird. This was in May, 1837, in Greenbrier County, Va."

William Brewster (1906), speaking of the bird in 1874, when he first found it in eastern Massachusetts, says: "If the species inhabited any part of the Cambridge Region before the year just mentioned, it was overlooked by several keen and diligent collectors, among whom may be mentioned Mr. H. W. Henshaw and Mr. Ruthven Deane." Since that time the bird has increased in numbers here until at present it is common in suitable localities.

Spring.—The goldenwing appears in eastern Massachusetts about the middle of May, or sometimes a little earlier, at the time when many of the resident warblers are arriving on their breeding-grounds. At this season the bright green leaves are beginning to open in the thickets and trees on the borders of woodlands where the goldenwing finds its food; and under the trees in the wooded swamps where the bird will build its nest, fresh new growth—skunkcabbage, ferns, and a host of spring plants—is pushing through the dead leaves, spreading a green carpet on the forest floor. But even thus early in the year, when the trees are nearly bare, it is not easy to see as it feeds high up in the trees, far out near the tips of the branches. Indeed, but for its queer little song, we should rarely suspect that it had come back to its summer home.

Nesting.—The golden-winged warbler builds its nest on the ground, generally raised somewhat by a substratum of dead leaves. The nest is supported by stalks of herbs—often goldenrod or meadow rue—or by fern fronds, or it may be hidden deep in a clump of grass, or it may lean against the base of a small shrub or tree with grass all about it. The leaves above the nest develop as the season advances and soon completely conceal it, and the plants, by their growth, may raise the nest a little above the ground. The cup of the nest is made chiefly of long strands of dry grass and narrow strips of grapevine bark, with a few hairs in the lining. This fine, flexible material is pressed down on the inside by the weight of the incubating bird and the nestlings, becoming smooth and firm like a mat, whereas on the outside wall the long grass blades and fibrous vegetable shreds are left free and, protruding loosely in all directions for some distance from the cup, produce a disorderly, unkempt appearance, like a little loose handful of fine hay.

Edward H. Forbush (1929) quotes an account of the goldenwing by Horace O. Green who has had an extensive experience with the species and who gives the following interesting details of the construction of the nest:

> The nest of the Golden-wing usually has a bottom layer of coarse dead leaves on which is placed a ring of large dry leaves, arranged with the points of the leaves downward, so that the leaf stems stick up noticeably around the edges of the nest proper, which is built within and upon this circular mass of leaves, and is made of rather wide strips of coarse grass or rushes, and usually has considerable grape vine bark interwoven in it. The nest lining is coarse and rough, sometimes the eggs being laid on the rough grape vine bark, and in some nests

other coarse fibers are used. A very characteristic feature of the nest lining is fine shreds of light reddish-brown vegetable fiber, which at first glance might easily be mistaken for dry needles from the pitch pine—but careful examination shows it to be the inner layers of the bark from the grape vines. The nest is very bulky for the size of the bird and is rather loosely put together by crossing the materials diagonally, so that it slightly resembles a rather coarse basket-work. I never saw a nest of this species which had a soft lining, such as many other warblers use—the eggs are apparently always deposited on rough material.

The general color of the nest is very dark, especially just after a rain, when the materials of which it is composed look almost black—this being one thing which helps to distinguish these nests from those of the Maryland Yellow-throat, which generally builds a much lighter colored nest, lined with fine grass, and sometimes with horse hair. Another small point of difference which is noticeable on close examination is that the lining in the Yellow-throat's nest is usually of a much finer and lighter colored material, and appears to be woven in horizontally, or at least to show some traces of such a design, especially around the upper edge—while the Golden-wing closely adheres to the diagonal criss-cross pattern with the loose ends of the nesting materials sticking up at an angle above the rim of the nest cavity.

Mr. Green describes the surroundings of the nest thus:

For their summer home these birds prefer the border of deciduous woods, where tall trees give plenty of shade, to an adjacent clearing with a growth of briers, bushes and grass, and the nest is usually placed just outside the line of the forest proper, but within the shade of the trees. A meadow wholly surrounded by woods is frequently selected. The ideal place to search for a nest of the species is in one of those woodland meadows, which has a clear brook flowing through it, with briers, tussocks of grass and a fresh growth of goldenrod scattered around in profusion, with birch trees and wild grape vines growing near the edges where the meadow meets higher ground—and all this bordered by tall oak, chestnut and maple trees which furnish an abundance of shade to the vegetation of the meadow itself.

J. Warren Jacobs (1904) describes the nest much as above and adds: "The opening is not straight down, but slightly tilted, the jaggy leaf-stems and bark sometimes reaching two or three inches above the rim of the nest proper. As incubation advances, the rough rim on the lower edge of the nest becomes broken down, and by the time the young birds are ready to leave, this part of their home is worn smooth by the attendant parents."

He gives the measurements of 17 nests as follows: "Outside 3.6 to 5.0 inches in diameter, and 3.0 to 5.0 inches in depth; and on the inside, from 1.7 to 2.5 inches in diameter by 1.3 to 2.5 inches deep." These measurements agree very closely with the records of several other observers. Jacobs continues: "Seemingly before the birds have had time to complete their nest, the female begins the deposition of the eggs. Generally, where I had opportunity to watch the nests daily, or at intervals between the beginning and completion of the set, the eggs were laid on consecutive days, but in two or three instances it was noticed that the laying missed a day."

Eggs.—The set for the golden-winged warbler may consist of anywhere from 4 to 7 eggs; 5 is perhaps the commonest number, but 4 is a common number, and the larger numbers are increasingly rare. The eggs are ovate or short ovate, and have only a slight luster. They are white or creamy white, with a wide variety of markings in "auburn," "argus brown," "Mars brown," "hazel," "Hay's brown," "liver brown," and "burnt umber," with underlying speckles or spots of "light brownish drab" and "light vinaceous drab." There is, also, much variation in the amount of markings, some being very sparingly speckled and others are quite heavily marked, with some of the spots assuming the proportions of blotches. Occasionally small hairline scrawls, or scattered spots, of brown so dark as to appear almost black, are found. The markings are usually denser toward the large end. The measurements of 50 eggs average 16.7 by 13.0 millimeters; the eggs showing the four extremes measure 18.6 by 13.0, 16.8 by 13.7, 15.5 12.5, and 15.9 by 12.3 millimeters (Harris).

Young.—Jacobs (1904) states that the incubation period is 10 days and that the young birds are able to leave the nest 10 days after hatching. In a nest which Maunsell S. Crosby (1912) watched closely, the eggs hatched on June 1 and the young flew on June 10.

The fledglings are delicate little birds, brownish olive on the back, washed with yellow below, and have two widely separated yellow wing bars. They have astonishingly long legs and soon become very active, fluttering about in the shrubbery and clinging to the branches. Walter Faxon (1911) in speaking of them gives this lively picture which could well be applied to them soon after leaving the nest: "In appearance and habit they were grotesque little fellows, clinging with their disproportionately long legs to the low herbage, like peeping Hylas in the springtime clinging to the grasses and weeds above the surface of the water. The little thread-like natal plumes still waving from the tips of their crown feathers enhanced the oddity of their appearance." Mr. Faxon, to be exact, is speaking here of some young birds of mixed parentage, but his words apply equally well to the behavior and appearance of the young of *chrysoptera* which he and I watched year after year together. Both parents are very attentive to their young brood, bringing to them food which they find both on low plant growth and high in the overshadowing branches.

The fledglings call to their parents with a very characteristic note, a little quavering, high, fine chirp which I find written in my journal *crrr* and *tzzz*. It suggests somewhat a note of young chipping sparrows, but is less sharp and crisp. In form it also resembles the call of the young cowbird, but again it is gentler and weaker in tone. Mr. Faxon (1911) refers to it as the "cricket note." The young birds acquire their first winter plumage about a month after they leave the nest, and hence to the eye are indistinguishable from their parents, but as they still continue to use the call of their babyhood, they may be recognized as immature birds even when they are feeding high up in the trees.

Plumages.—[Author's Note: I can find no description of the natal down. Dr. Dwight (1900) describes the juvenal plumage, in which the sexes are practically alike, as "above, grayish or brownish olive-green. Wings and tail slate-black edged chiefly with bluish plumbeous gray, the coverts and tertiaries with olive-green. Below, pale olive-yellow, the throat dusky. Transocular streak dusky. * * *

"First winter plumage acquired by a partial postjuvenal moult, beginning early in July, which involves the body plumage and wing coverts, but not the rest of the wings nor the tail, young and old becoming practically indistinguishable." He describes the young male in this plumage as—

> above, plumbeous gray veiled with olive-green edgings; the crown bright lemon-yellow veiled posteriorly only. Below, grayish white, with yellow edgings here and there, the chin, jugulum, lores and auriculars jet-black veiled slightly with pale buff. Broad submalar stripes joining at angle of the chin, and superciliary lines white. Outer half of median and greater coverts bright lemon yellow forming an almost continuous wing patch, lesser coverts plumbeous gray, edged with olive-green.
>
> First nuptial plumage acquired by wear, through which the buff edgings of the black areas, the olive edgings of the back and the yellow edgings below are almost completely lost, the plumage becoming clear gray, white, yellow and black.

Of the female, he says: "In first winter and other plumages olive-gray, dusky on the lores and auriculars, replaces the black areas of the male, and olive-yellow marks the crown. Above, the plumage is greenish; the submalar stripes are grayish." Subsequent plumages are acquired by a complete postnuptial molt in late June and July and by wear in early spring.]

Food.—Little exact information has been gathered regarding the food of the goldenwing. The insects it feeds on are mainly so small that it is generally impossible to identify them. Jacobs (1904) states: "Once I saw a female carry a small brownish butterfly to her young; and several times I have discovered the birds taking small smooth green worms—such as strip the leaves of their green coat, leaving the ribbed skeleton—to their nestlings. The legs of a spider protruded from a bird's bill as she approached her nest."

The little pale green larva which Jacobs mentions impresses us as the chief article of food, as we watch the birds. It is ½ to ¾ inch long and appears to have a smooth, hairless skin. These larvae are obtained, I believe, chiefly in the large trees.

In the following note A. L. Nelson (1933) furnishes an interesting detail of the bird's diet:

> The following observation on the food habits of a Golden-winged Warbler (*Vermivora chrysoptera*), made in the vicinity of Port Tobacco (Charles Co.), Maryland on May 6, 1933, seems worthy of mention, inasmuch as little specific information on the dietary habits of this species has been recorded. About 1:30 we observed a single individual of this species actively feeding in a low shrubbery growth of pawpaw (*Asimina triloba*), which was in full bloom at this date. Closer observation revealed that the bird was probing about inside the flowers, and apparently was getting some kind of larvae. Examination of the flowers revealed that they were infested with a small, brown-headed lepidopterous larva. Dissection of a large number of flowers indicated that the infestation was high, the majority of flowers having one larva, although in many cases two were present. Several infested flowers were collected for the purpose of rearing the insects to the adult stage under laboratory conditions. The cycle was completed without difficulty, the adults emerging within twelve days. These were examined by Dr. Carl Heinrich of the U. S. National Museum and found to be *Talponia plummeriana* Busck, a small brightly colored Tortricid, the only known food plant of which is the pawpaw.

Behavior.—A favorite locality for the golden-winged warbler to spend the summer in eastern Massachusetts may be the border of a wooded swamp where tall elm and maple trees shade a dense undergrowth of ferns and other moisture-loving plants, a swamp which runs out toward drier ground where abounds a growth of gray birches or a tangle of raspberry canes, wild grapevines, and goldenrod. Such a spot furnishes countless situations for hiding the nest in the thick vegetation growing in the half-wet half-dry ground, and also a source of food near at hand in the high branches of the trees. Much the same conditions exist along the course of a brook winding through second growth, or near orchards or old neglected weedy pastures.

Sometimes, as William Brewster (1906) points out, the bird may frequent "dry hillsides covered with a young sprout growth of oak, hickory or maple."

In a more southern latitude the habitat may be quite different. Maurice Brooks (1940), speaking of the bird in the central Allegheny Mountain region, says: "Shunning the swamps which it frequents in other portions of its range, it is highly characteristic of the 'chestnut sprout' association, where the males choose dead chestnuts for perches from which to sing. It is also fairly common in the pitch and scrub pine regions on the hills just back of the Ohio river, but becomes less common toward the eastern portion of the territory with which this paper deals. It ascends to at least 4,000 feet in Giles Co., Va."

We can watch the little golden-winged warblers best, and often at very short range, when they are feeding their fledglings recently from the nest. The little birds sit quietly in the shrubbery near the ground, waiting for their parents. We can find them easily, for they frequently utter their characteristic "cricket note," and we can approach them closely, for they scarcely heed us. The parents, too, when they are feeding the young birds, pay little attention to us and come fearlessly to them even when we stand near. At such times they work in a seeming panic of hurry, flying about in the low growth searching for food, or visiting the smallest branches high up in the trees, where they cling to the terminal twigs, hanging like chickadees as they probe among the curled up leaves (insect nests) for food hidden there, then back to the waiting young, seemingly in continuous motion and without the slightest pause in their nervous activity. At this season when the parents are busy with the young birds, about the third week in June in eastern Massachusetts, they are so occupied in searching for food that the male rarely sings.

In two particulars—their tameness, or indifference to our presence, and the almost complete cessation of singing thus early in the season—the goldenwing differs from the other common birds which breed in much the same regions, the chestnut-sided warbler, redstart, northern yellowthroat, ovenbird, and veery.

Jacobs (1904) speaks of the anxiety of the parent birds if the nest is disturbed when the nestlings are nearly ready to fly. He says: "If the hand is placed near the nest at this period of their growth, they will scramble out and flutter away, all giving vent to their chipping note, which brings down upon the intruder the wrath of both old birds, who fly close to his face, snapping their beaks and chipping loudly; then down upon the ground they fall and feign the broken wing act as long as one of the young continues to chirp."

Voice.—The song of the golden-winged warbler is an inconspicuous little buzzing sound which one might pass by unnoticed, or hearing it for the first time, might ascribe it to a mechanical sound made by some insect, not suspecting it to be the song of a bird. Only after we have become thoroughly familiar with the song do we grasp its definite character, so that we can pick it out even when we hear it in the distance among a medley of other voices. In this particular it resembles the songs of Henslow's and the grasshopper sparrows, which are scarcely audible, and pass unregarded until well known.

The male goldenwing sings generally from a high perch, often from a branch bare of leaves; hence, once we find him, we can see him plainly. When he sings he throws his head back so far that his bill points almost to the zenith, and sings with it widely open, as if he were pouring out a great volume of sound. The bird sings freely from his arrival in spring until mid-June, about a month, often devoting himself to long periods of singing from the same perch.

Later in the season, after the young have hatched, he sings only fitfully.

The song most often heard is composed of four notes, the first prolonged, and followed, after an almost imperceptible pause, by three shorter notes on a lower pitch. All four notes are delivered in a leisurely manner, drawling in tempo, and might be written *zeee, zer-zer-zer*. The first note takes up about half the time of the song. The quality of the voice is buzzing, and when heard near at hand, slightly rasping, with a lisping suggestion throughout. The song carries well; curiously it seems little louder when heard at close range, but from a distance it sounds smoother and, losing much of the buzzing quality, suggests a long drawn out *thth, th-th-th*, like a whispering wind. Occasionally there may be four short notes, and sometimes only two following the long initial note.

Like some of the other warblers, notably the black-and-white, chestnut-sided, and black-throated green, the goldenwing sings two distinct songs. In the second form the buzzing tone is nearly or wholly absent. It begins with about half a dozen short notes given in a quick series on the same pitch, and ends with one long note on a higher key, *th-th-th-th-th-th-theee*.

I have heard two males singing antiphonally, the responses repeated with perfect regularity for several minutes.

Of the minor notes the commonest is a short, slightly roughened *dz*. When much excited both adults use a chattering *tchu-tchu-tchu*, suggesting in manner of delivery the song of the short-billed marsh wren, although it is higher pitched and not so loud.

Francis H. Allen (MS.) mentions two other songs, only slightly different from the above. One goes something like "*tick tick chick chick chick chick shree.* The *shree* is a beady note resembling one of the cedar waxwing's familiar notes." Another song he writes as "*see-see-see-see-see-see-see-see-see-dz′-dsee.*"

Field marks.—The golden-winged warbler is easy to recognize; it is the only warbler that combines a blue-gray back and yellow in the wing. In the two other common warblers with a black throat, the black-throated blue and the black-throated green, the black runs down the sides a little way so that the white of the breast comes up in a peak in the middle of the breast, whereas in the goldenwing the line of division between the black and white runs straight across. From directly below, the goldenwing appears wholly black and white, and from this angle is marked like a chickadee, but a glance at its long, needle-sharp bill proclaims it a warbler of the genus *Vermivora.*

Enemies.—Prowling mammals, the enemies of ground-nesting birds, and predatory hawks are a danger to the bird. In its relation to the cowbird, Friedmann (1929) reports the bird as "a very uncommon victim." He says: "I have only six definite records, but the species is listed as a molothrine victim by Bendire and by Short. As many as four eggs of the Cowbird have been found in a single nest of this Warbler."

Fall and *winter*.—We lose sight of the goldenwing early in the season. Silent amid the dense foliage of July and August, the bird is rarely seen. During the years between 1907 and 1920, when I kept a daily record of birds seen, I met it only four times in August and only twice in September, the latest September 12.

Dr. Alexander F. Skutch sends to A. C. Bent the following account of the bird in its winter quarters: "I am familiar with the golden-winged warbler in its winter home only in Costa Rica. In this country it winters on the Caribbean slope from the lowlands up to about 6,000 feet above sea-level, and on the Pacific slope at least in the region between 2,000 and 4,000 feet. While it appears to be nowhere abundant, I found it most numerous at Vara Blanca, on the northern slope of the Cordillera Central at an elevation of about 5,500 feet. Here on one day—November 2, 1937—I saw three individuals, the greatest number I have ever recorded. This is a region of dense vegetation, subject to much cloudiness and long-continued, often violent rainstorms—one of the wettest districts of all Central America. Most of the published records are from this generally wet side of the country. Yet the bird winters sparingly in the Basin of El General on the Pacific slope, which during the first 3 months of the year may be nearly rainless. While in the Tropics, it appears never to associate with others of its own kind, but at times may roam about with mixed flocks of other small birds. It may forage among low, fairly dense, second-growth thickets, or among the tangled vegetation at the forest's edge, or at times in the forest itself, or in groves of tall trees, high above the ground. It investigates the curled dead leaves caught up among the branches, and devours such small creatures as it finds lurking in their folds. I have not heard it sing while in its winter home.

"In Costa Rica, it appears to arrive late and to depart early, not having been recorded before September 15, nor later than April 9. Early dates of fall arrival are: Costa Rica—San José (Cherrie), September 15 and October 2; La Hondura (Carriker), September 21; Basin of El General, October 18, 1936; Vara Blanca, October 5, 1937.

"Late dates of spring departure are: Costa Rica—Basin of El General, April 8, 1936, April 7, 1937, March 30, 1939, and April 9, 1943; Vara Blanca, April 9, 1938; Guápiles (Carriker), March 30."

DISTRIBUTION

Range.—Eastern United States to northwestern South America.

Breeding range.—The golden-winged warbler breeds **north** to central Minnesota (Detroit Lakes, Onamia, and Cambridge); central Wisconsin (St. Croix Falls, New London, and Shiocton); northern peninsula of Michigan (McMillan and Mackinac Island); southern Michigan (Kalamazoo, Locke, and Detroit); southern Ontario (London and Port Rowan, has occurred north to Collingwood and Bowmanville); central New York (Medina, Rochester, and Waterford); central Vermont (Rutland), and northern Massachusetts (Winchendon, Newton, and Lynn). It has been found in summer and may possibly breed in southern New Hampshire (Concord and Durham); and southwestern Maine (Emery Mills and Sandford). **East** to eastern Massachusetts (Lynn, Boston, and Rehoboth); southern Connecticut (New Haven and Bridgeport); northern New Jersey (Morristown); central Pennsylvania (near State College); and south through the mountains to western North Carolina (Weaverville, Waynesville, and Highlands); northwestern South Carolina (Caesars Head and Highlow Gap); and northern Georgia (Young Harris, Margret, and Oglethorpe Mountain). **South** to northern Georgia (Oglethorpe Mountain and Rising Faun); central Tennessee (Maryland); northern Ohio (Steuben, Port Clinton, and Wauseon); northern Indiana (Waterloo); and northern Illinois (Riverside). **West** to northern Illinois (Riverside); central and western Wisconsin (Baraboo Bluffs and Durand); and central Minnesota (Minneapolis, Elk River, and Detroit Lakes). It has been noted in summer, or in migration, west to St. Louis, Mo.; Lake Quivira and Lawrence, Kans.; and Omaha, Nebr.

Winter range.—In winter the golden-winged warbler is found **north** to central Guatemala (Cobán); and northern Honduras (Lancetilla); casually or in migration to the Yucatán Peninsula (Campeche and Mérida). **East** to Honduras (Lancetilla); eastern Nicaragua (Escondido River); Costa Rica (Guápiles and Guayabo); central Panamá (Lion Hill, Canal Zone); and central Colombia (Santa Marta region, Bogotá, and Villavicencio); rare or accidental in western Venezuela (Mérida). **South** to central Colombia (Villavicencio and El Eden). **West** to northwestern Colombia (El Eden, Medellín, and Antioquia); western Panamá (Chiriquí); Costa Rica (El General and Nicoya); and central Guatemala (Cobán).

Migration.—Late dates of spring departure are: Colombia—Fusagasugá, March 24. Panamá—Volcán de Chiriquí, April 16. Costa Rica—Vara Blanca, April 9. Florida—Pensacola, April 22. Alabama—Hollins, May 7. Georgia—Athens, May 13. South Carolina—Clemson College, May 3. North Carolina—Raleigh, May 7.

District of Columbia—Washington, May 20. Mississippi—Gulfport, April 18. Missouri—St. Louis, May 25.

Early dates of spring arrival are: Florida—Pensacola, April 5. Alabama—Barachias, April 22. Georgia—Milledgeville, April 12. South Carolina—Clemson College, April 21. North Carolina—Asheville, April 23. Virginia—Lynchburg, April 19. West Virginia—Bluefield, April 19. District of Columbia—Washington, April 24. Pennsylvania—Beaver, April 24. New York—Rochester, April 29. Massachusetts—Belmont, April 28. Louisiana—Grand Isle, April 6. Mississippi—Gulfport, April 10. Tennessee—Memphis, April 12. Illinois—Olney, April 17. Indiana—Sedan, April 27. Michigan—Plymouth, April 30. Ohio—Youngstown, April 27. Ontario—London, April 30. Missouri—St. Louis, April 18. Iowa—Keokuk, April 27. Wisconsin—Sheboygan, April 30. Minnesota—Minneapolis, April 30. The golden-winged warbler ranges west to central Iowa in migration, and in the lower Mississippi Valley is much less abundant in spring than in fall.

Late dates of fall departure are: Minnesota—Minneapolis, September 30. Wisconsin—Madison, October 11. Ontario—Point Pelee, September 2. Ohio—Ellsworth Station, September 23. Michigan—Ann Arbor, October 6. Indiana—Lyons, September 27. Illinois—Chicago, October 7. Missouri—La Grange, September 30. Kentucky—Versailles, September 25. Tennessee—Athens, September 29. Louisiana—New Orleans, September 25. Mississippi—Gulfport, October 8. Massachusetts—Danvers, September 7. New York—Brooklyn, October 2. Pennsylvania—Jeffersonville, October 2. District of Columbia—Washington, September 14. West Virginia—French Creek, September 15. North Carolina—Piney Creek, October 3. South Carolina—Chester, September 22. Georgia—Atlanta, October 9. Alabama—Greensboro, October 4.

Early dates of fall arrival are: Mississippi—Bay St. Louis, July 23. District of Columbia—Washington, August 8. Virginia—Naruna, August 23. North Carolina—Highlands, August 15. South Carolina—Charleston, August 20. Georgia—Athens, August 14. Alabama—Greensboro, August 11. Florida—Pensacola, August 14. Costa Rica—San José, September 15. Colombia—Bonda, September 6.

Casual record.—One reported seen at Fort Thorn, N. Mex., in April 1854 by Dr. Joseph Henry. Since no specimen was taken this remains on the hypothetical list for the State.

Egg dates.—Massachusetts: 14 records, May 27 to June 24; 9 records, May 30 to June 7, indicating the height of the season.

Michigan: 33 records, May 13 to June 10; 18 records, May 17 to 30.

New York: 6 records, June 3 to 24.

New Jersey: 7 records, May 25 to June 5 (Harris).

VERMIVORA PINUS (Linnaeus)

BLUE-WINGED WARBLER

Plates 12, 13

HABITS

Bagg and Eliot (1937) write: "According to Wilson, this species was discovered by William Bartram, who gave it the descriptive name *Parus aureus alis caeruleis* (Blue-winged Golden Tit), and sent a specimen to 'Mr. Edwards' by whom it was drawn and etched. Edwards suspected its identity with the Pine Creeper of Catesby: hence its present inappropriate name, *pinus*." As there are other warblers whose wings are more distinctly blue, those of this warbler being only bluish gray, the old familiar name, blue-winged yellow warbler, which stood for many years, seems more appropriate and more truly descriptive.

The blue-winged warbler is a bird of the so-called Carolinian Life Zone, with a rather restricted breeding range in the Central States and not quite reaching our northern borders. Its center of abundance in the breeding season seems to be in southern Ohio, Indiana, Illinois, northern Kentucky, northern Missouri, and southern Iowa. Its range extends northeastward to New Jersey, southeastern New York, and southern Connecticut. It is fairly common in the latter State, and I know of one small colony in eastern Rhode Island within a mile or two of the Massachusetts line. North of these points in New England it occurs only as a straggler or casual breeder. In southern New England I have found it in rather open situations, in neglected pastures where there is low shrubbery, brier patches, and bushy thickets around the edges; or in similar growth along the borders of woods, usually on dry uplands; and sometimes in the rank growth of tall grasses and weeds near the borders of swamps or streams.

Frank L. Burns wrote to Dr. Chapman (1907) of its haunts in Pennsylvania: "This species is here an inhabitant of the rather open swampy thickets, upland clearings, neglected pastures and fence rows, where the grass and weeds have not been choked out by a too thick growth of briers, bushes, saplings and vines." Dr. Lawrence H. Wilkinshaw tells me that, in southern Michigan, "this species loves deep swampy woods, where the golden-winged warbler and cerulean warbler are found." This is quite different from the haunts in which we find it in the east, though Dr. Chapman (1907) says: "It is not, as a rule, a deep woods warbler, though I have found it nesting in heavy forest, but prefers rather, bordering second growths, with weedy openings, from which it may follow lines or patches of trees to haunts some distance from the woods."

Spring.—From its winter home in Central America the blue-winged warbler seems to migrate from Yucatán straight across the Gulf of Mexico to the Gulf States and along the eastern coast of Texas to Louisiana. It is apparently very rare anywhere in Florida or the Keys, and along the Atlantic coast, where it is comparatively rare, it is found at low elevations. It migrates northward mainly west of the Alleghenies, seeming to avoid the mountains; the main body of the species seems to travel through the Mississippi Valley to the centers of abundance in the central States. Perhaps the birds that settle in southern New York and New England travel up the Ohio River, drifting through Pennsylvania and New Jersey to their destination. According to Milton B. Trautman (1940) this warbler seems to be a rare or uncommon spring migrant in central Ohio, and "in some migrations only 2 individuals were noted" at Buckeye Lake; this adds support to the theory that the birds follow the river along the southern border of the State.

Nesting.—Although Wilson (1831) gave a very good description of the nest of the blue-winged yellow warbler, very little was known of its nesting in southern New England prior to about 1880, when nests were found in southern Connecticut, where it is now known to be a fairly common breeder. I found two nests near West Haven, Conn., on June 3, 1910; both were close to the ground but not quite on it; one was in a clump of blackberry vines, weeds, and grasses, in a swampy corner of a scrubby lot; the other was in a bunch of grass and rank weeds on some sprout land among some mixed bushes. Again, on June 1, 1934, I photographed (pl. 12) a nest near Hadlyme, Conn., on the edge of an open, neglected field and close to the border of some young woods. It was built among and attached to the upright stems of a clump of tall goldenrod. These were all typical of the nests described below.

Massachusetts nests are very rare; Forbush (1929) gives but two nesting records for this State, and only one for Rhode Island, though I am confident that its breeds regularly in the latter State. Horace W. Wright (1909b) gives a very full account of a nest found near Sudbury, Mass., in some mixed woods, placed between the exposed roots of a decayed stump and partially concealed by a growth of ferns.

T. E. McMullen has sent me the data for several Pennsylvania nests, three in old fields, one under a cherry sprout, one under a small bush, and one 6 inches up in a tussock of goldenrod; another was under a birch sprout along the edge of an old woods road.

The nest of the blue-winged warbler is unique and quite distinctive, often shaped like an inverted cone, usually very narrow and very deep and supported by a firm cup of strong, dead leaves. I cannot improve on the excellent description given to Dr. Chapman (1907) by Frank L. Burns as follows:

> Outwardly composed of the broad blades of a coarse grass, the dead leaves of the maple, beech, chestnut, cherry and oak trees; the leaf points curving upward and inward forming a deep cuplike nest in which the bird's head and tail seem almost to meet over her back. Occasionally grass stems, coarse strips or wild grapevine bark, shreds of corn fodder, and fragments of beech and wild cherry bark appear in the make-up. Lined most frequently with wild grapevine bark laid across, instead of bent around in a circle, shredded finest on top, to which is added an occasional long black horse-hair or split grass stem, with now and then a final lining of split grass stems in place of fine bark. The shape varies in accordance to situation, outwardly a short cornucopia, a round basket, and once a wall-pocket affair, would best describe the shapes I have noticed.

Eggs.—From 4 to 7 eggs may be found in the nest of the blue-winged warbler; 5 seems to be the commonest number, and sets of 6 are not very rare. The eggs are ovate, with a tendency to short ovate, and they have only a slight gloss. The white ground color is finely speckled or sparingly spotted with "chestnut brown," "mummy brown," and "sayal brown," with under markings in shades of "drab-gray." Some sets have three or four eggs that are almost immaculate, with one egg sparingly spotted; other sets occasionally are prominently spotted with "drab-gray," "light Quaker drab," and "dark vinaceous-drab," or, less often, with spots of dark "mummy brown." Usually the majority of the markings are confined to the large end. The measurements of 50 eggs average 15.7 by 12.5 millimeters; the eggs showing the four extremes measure **16.8** by **13.0** and **14.2** by **11.6** millimeters (Harris).

Young.—An egg is laid each day until the set is complete, and incubation generally begins when the last egg is laid. The period of incubation is 10 or 11 days, and the young remain in the nest from 8 to 10 days. Mr. Burns gave Dr. Chapman (1907) the following full account of the nest life:

> The task of incubation falls on the female alone. It appears that an airing is taken in the early morning or a little before midday, and again in the early evening, though perhaps not regularly every day. I have not seen the male about the nest with food at this period. The female will allow a close approach, looking into one's eyes with that hunted look so common in wild animals, and often flushing without a protesting note. The period of incubation in the one instance was exactly ten days.
>
> On June 13, at 6.30 p. m., five young just hatched were blind, naked and prostrate from chin to sternum. The shells were disposed of immediately, in what manner I am unable to state; the female was reluctant to vacate.
>
> On June 15, at 2.45 p. m., the young were able to raise their heads slightly and a fluffy bit of down had appeared about the head, also a dark stripe along the back bone. The female appeared, accompanied by the male, and fed the young with

small green larvae—such as may be found on the under-side of oak and chestnut leaves—and then shielded the callow young from the hot rays of the sun.

On June 16, at 6.30 p. m., when the young were three days old, a downy puff appeared between the shoulders, wing quills being dark. The strongest bird had the eyes partly open and the mouth wide open for food.

On June 18, at 7 p. m., the heads and bodies were no longer flesh-colored but were well enough covered to appear dark. The eyes were open. At a *cluck* from me their mouths flew open. Both parents fed them with green-colored larvae. When the male rested a moment on a brier above the nest, the female flew down and drove him away, fed the young, re-appearing with excrement in her beak, which was carried in an opposite direction from the regular approach via maple bough and poplar sapling. The male fed the young from a mouthful of very minute larvae or eggs, which were gathered from the silken nests in the unfolding leaves of a nearby poplar; after this (7.30 p. m.) the female covered the young for the night.

On June 20, at from 6.50 to 7.35 p. m., the young had been seven days in the nest. They were well feathered and of a yellowish-green cast, the short tails being tipped with yellow. The parents were more suspicious. The female came to the maple bough with something in her beak and flew down to the briers and back again several times before she dropped to the edge of the nest and fed her young. The male appeared immediately but swallowed a green grub himself upon discovery of me twenty-five feet away. The female came again in five minutes with a brownish object in her bill, but appeared more timid and refused to drop to the nest until the male set her an example of courage.

On June 21, at 6.12 p. m., the young were fully fledged in green plumage above and dirty yellow beneath. They showed fear of me for the first time, eyeing me in the same manner as the parent bird when on the nest. They were evidently ready to vacate at a moment's notice or hasty movement on my part. The parents appeared, scolding rapidly. The female fed the young as soon as I retired to my old stand under a bush, with a rather large green grub (6.20 p. m.) and flew out to the top of a blackberry bush, followed immediately by the topmost fledgling. It could do little more than run. The adults flew to within a yard of my head, making a great outcry, and in the midst of the excitement the remainder of the young vacated the nest with feeble *chips*. The male gave his attention to them, while the female followed me as I beat a hasty retreat to enable them to collect their little family before dark. Eight days had elapsed since incubation was completed, and it is not at all unusual for the young of this species to leave the nest while so tiny and ragged.

Plumages.—Dr. Dwight (1900) calls the natal down "mouse-gray," and describes the juvenal plumage, in which the sexes are alike, as, "entire body plumage olive-yellow darkest on the back and throat. Wings and tail slate-gray largely edged with plumbeous gray, the tertiaries and coverts with olive-yellow; the greater and median coverts tipped with white, yellow tinged. Rectrices largely white. Lores dusky."

A partial postjuvenal molt begins early in July, involving the contour plumage and the wing coverts, but not the rest of the wings or the tail. This molt produces the first winter plumage in which the sexes are very much alike, the female being duller in color, especially the streak through the eye, and having less yellow on the crown. Dr. Dwight (1900) describes the first winter male as "above, bright olive-green, lemon-yellow on the crown veiled by greenish tips. Below, bright lemon-yellow, the crissum white or merely tinged with yellow. Transocular streak black. Wing coverts plumbeous gray, edged with olive-green, the greater and median tipped with white, yellow tinged, forming two broad wing-bands."

The birds are now practically adult in plumage. The first and subsequent nuptial plumages are acquired by wear, which produces little change beyond removal of the greenish tips. Subsequent winter plumages are acquired by a complete postnuptial molt each July.

The interesting hybrids between this and the golden-winged warbler are discussed on pages 3 and 4. Kumlien and Hollister (1903) mention a probable mating of this with the Nashville warbler.

Food.—Nothing seems to have been published on the food of the blue-winged warbler beyond that mentioned above as food given to the young, which is doubtless eaten by the adults as well. It is apparently wholly insectivorous, seeking its food near the ground in the weed patches and underbrush where it lives and among the lower branches of the trees in its haunts. Probably any small insects that it can find in such places, as well as their larvae and eggs, including many small caterpillars, are eaten. Small grasshoppers and spiders are probably included. Prof. Aughey (1878) observed it catching small locusts in Nebraska. It is evidently a harmless and a very useful bird in destroying insects that are injurious to foliage.

Behavior.—Dr. Chapman (1907) writes: "It is rather deliberate in movements for a Warbler, and is less of a flutterer than the average member of the genus *Dendroica.* Some of its motions suggest those of the tree-inhabiting Vireos, while at times, as the bird hangs downward from some cocoon it is investigating, one is reminded of a Chickadee." And he quotes Burns as follows:

> Perched inconspicuously near the top and well out on the branchlets of a tree or sapling, preferably facing an opening, if in a thicket; it is in itself so minute an object as to be passed unseen by many, more especially as it is much less active than most of our Warblers. With body feathers puffed out to a delightful plumpness, except for the backward sweep of the head while in the act of singing, it remains motionless for quite a while. When it moves it is with a combination of nervous haste and deliberation, and its song may be heard from quite another part of the landscape with no apparent reason for the change. While it has its favorite song perches, it is quite a wanderer and not infrequently sings beyond possible hearing of its brooding mate, but oftener within fifty to two hundred feet of the nest.

Voice.—Aretas A. Saunders contributes the following study of the songs of this warbler: "The territory song of the blue-winged warbler consists of two long, buzz-like notes, the second usually lower in pitch than the first and rougher in sound, *bzzzzzz–brrrrrrr.* The pitch interval between the two notes varies from one tone to four and a half tones, but the smaller intervals, one tone and one and a half tones, are much commoner. The second note is lower in pitch than the first in about 75 percent of my records, and higher in most of the others. In a few songs the second buzz is a double note, and one may hear both lower and higher notes from a medium distance, only the lower from a greater distance, and only the higher when very near the bird.

"The pitch is not high as compared to other warblers, ranging from C′′′ to D′′′′, one tone more than an octave. The territory song commonly begins on some note from A′′′ to C′′′′. It varies in time from 1⅕ to 1⅘ seconds, the first note being either equal to or shorter than the second. The second note is often twice as long as the first. In some songs the second note is broken into two notes, and in one record it is in four short notes, so that the song is essentially like that of the golden-winged warbler.

"After the birds have been on the breeding grounds for a week or two, singing of the nesting song begins. This song has the same buzz-like quality as the other, but it is exceedingly variable, considerably longer, and hardly ever twice alike. The song often begins with a series of short notes, like *tsit tsit tsit*, or contains such notes somewhere in the middle. There are usually long buzzes that change pitch by slurring upward or downward. On one occasion, I found a bird that sang a territory song and four different nesting songs. Often the nesting song is sung in flight. By June this song is heard about as frequently as the territory song, and in late summer, after the molt, it is the one most commonly heard.

"The song of this bird is heard from its arrival in spring until early July, when it ceases for a time. It is usually revived in late July or early August, and from then on may be heard fairly frequently until the birds depart about the last of August."

In his notes sent to Dr. Chapman, Burns describes the song as, "a drowsy, locust-like, *swe-e-e-e-e ze-e-e-e-e*, the first apparently inhaled and the last exhaled. * * * Another song heard on the first day of arrival, on one occasion, uttered by several males in company, possibly transients here, and may be the mating song, suggests the Chickadee's *che-de-de-e*, *che-dee-e*, and *che-de-de-dee*, uttered repeatedly in one form or other in excitement, and while running out on the branchlets. The call and alarm note is a rather weak *chip*." Dr. Chapman (1912) records a longer song, heard later in the season as "*wēē-chĭ-chĭ-chĭ-chĭ, chūr, chēē-chūr.*"

Francis H. Allen tells me that the final note, *ze-e-e-e-e*, as rendered by Burns, "is really a very rapid series of *pips*, as if the bird had lips like ours and vibrated them by forcing the air through them—in other words, giving a sort of avian Bronx cheer, but high in pitch.

The individual *pip* notes are clear, but the effect of the rapid succession is somewhat buzzy."

The songs of the hybrid forms may be like the song of either parent form, more often like that of the goldenwing, or a mixture of the two.

The flight song, as heard by Frank A. Pitelka, is recorded as follows:

tsee-
zweé- *zweé*
tzip- *tzip-*
zee-zee-zee-zee-zee-zee- *zee-zee-zee-zee-zee-zee-*

The song of the blue-winged warbler is one of the high-frequency songs; Albert R. Brand (1938) gives the approximate mean as 7,675, the highest note about 8,050 and the lowest note about 7,125 vibrations per second; this compares with an approximate mean for the blackpoll warbler of 8,900 vibrations per second, the highest frequency of any of the wood warblers, and an average for all passerine birds of about 4,000 vibrations per second.

Field marks.—A small warbler with a greenish olive back, yellow forehead and under parts, with a black line through the eye and two white wing bars, is a blue-winged warbler. The female is merely more dull in coloration than the male, and the young even duller. The hybrids between this and the golden-winged warbler are more puzzling, but in a general way they can be recognized; a nearly typical blue-winged warbler with a black throat is probably a Lawrence's warbler; and a golden-winged warbler without a black throat or cheek and with a variable amount of white and yellow on the under parts and in the wing-bars, is probably a Brewster's warbler. But there is an immense amount of individual variation between the two species, due to frequent crossing.

Fall.—Most of the blue-winged warblers move southward during August and September, though a few may linger in the southern part of the breeding range into October. Professor Cooke (1904) says: "Most of the individuals of the species migrate across the Gulf of Mexico, apparently avoiding Florida on the east and Texas and Vera Cruz on the west, as there is no record of the occurrence of this warbler in fall in Texas, and but one in Florida—that of a bird taken at Key West August 30, 1887." But this remains to be proved.

Alexander F. Skutch writes to me: "This is another very rare migrant in Central America. It has been recorded only a few times in Guatemala and apparently not at all in Costa Rica. I have seen it only once, on the Finca Mocá, Guatemala, on October 30, 1934."

Very little seems to be known about its winter distribution and still less about its winter habits.

DISTRIBUTION

Range.—Eastern United States to Panamá.

Breeding range.—The blue-winged warbler breeds **north** to southeastern Minnesota (Lanesboro); southern Wisconsin (Mazomanie, Prairie du Sac, and Glarus); northeastern Illinois (Rockford, Deerfield, and La Grange); southern Michigan (possibly Hastings, and Ann Arbor); northern Ohio (Toledo, Lakeside, Cleveland, and Austinburg); southern Pennsylvania (Carlisle); southern New York (Ossining and Whaley Lake); and Massachusetts (Springfield and Sudbury). **East** to eastern Massachusetts (Sudbury and Lexington); Connecticut (Westfield and Saybrook); Long Island (Mastic and Oyster Bay); New Jersey (Demarest, Morristown, and Elizabeth); southeastern Pennsylvania (Tinicum and Berwyn); probably occasionally in northern Maryland (Cecil County and Sabillasville); eastern and central Ohio (Canfield and Columbus); east-central Kentucky (Berea); central Tennessee (Nashville and Fall Creek); and central northern Georgia (Young Harris). **South** to northern Georgia (Young Harris, Margret, and Atlanta); northeastern Alabama (Long Island); central Tennessee (Wildersville); and northwestern Arkansas (Pettigrew and Winslow). **West** to northwestern Arkansas (Winslow and Fayetteville); west-central Iowa (Warrensburg); eastern Iowa (Lacey, Grinnell, Winthrop, and McGregor); and southeastern Minnesota (Lanesboro). The blue-winged warbler has occurred in summer west to eastern Kansas (Emporia and Leavenworth); central-southern and eastern Nebraska (Red Cloud, Plattsmouth, and Omaha); western Iowa (Sioux City); and north to Minnesota (Minneapolis); southern Ontario (Point Pelee, Strathroy, and West Lake); central New York (Penn Yan and Auburn); and southern New Hampshire (Manchester).

Winter range.—The principal winter home of the blue-winged warbler seems to be in Guatemala, though it has been recorded in winter from the Valley of Mexico; Puebla (Metlatoyuca); Veracruz (Tres Zapotes); to eastern Nicaragua (Río Escondido and Greytown). There is one winter record each from Costa Rica (Bonilla), Panamá (Port Antonio), and Colombia (Santa Marta Region).

On January 6, 1900, a dead blue-winged warbler (apparently dead from starvation) was picked up in Bronx Park, New York. It had only recently died and in all probability was the bird seen on December 10, in the same region.

Migration.—Late dates of spring departure are: Colombia—Santa Marta Region, March 21. Veracruz—Jalapa, April 7. Florida—Pensacola, April 25. Alabama—Guntersville, May 2. District of

Columbia—Washington, May 30. Louisiana—Monroe, April 27. Texas—San Antonio, May 12.

Early dates of spring arrival are: Florida—Pensacola, April 4. Alabama—Shelby, April 4. Georgia—Atlanta, March 26. North Carolina—Arden, April 18. District of Columbia—Washington, April 23. West Virginia—Wheeling, April 23. Pennsylvania—Germantown, April 25. New York—Yonkers, April 26. Massachusetts—Lexington, May 6. Mississippi—Bay St. Louis, March 13. Louisiana—New Orleans, March 23. Arkansas—Winslow, April 2. Tennessee—Nashville, April 7. Kentucky—Eubank, April 10. Illinois—Springfield, April 29. Ohio—Columbus, April 22. Michigan—Ann Arbor, May 1. Missouri—St. Louis, April 17. Iowa—Grinnell, April 28. Wisconsin—Reedsburg, April 30. Minnesota—Lanesboro, May 7. Texas—Cove, March 27. Kansas—Onaga, April 26.

Late dates of fall departure are: Minnesota—Lanesboro, September 1. Wisconsin—Elkhorn, September 19. Iowa—Giard, September 20. Missouri—Monteer, September 17. Arkansas—Winslow, September 18. Louisiana—Monroe, October 7. Michigan—Jackson, September 13. Ohio—Oberlin, September 27. Indiana—Bloomington, September 28. Illinois—Chicago, September 29. Kentucky—Bowling Green, October 5. Tennessee—Memphis, September 11. Mississippi—Deer Island, October 13. Massachusetts—Belmont, September 6. New York—New York City, September 25. Pennsylvania—Jeffersonville, September 19. District of Columbia, Washington, September 14. West Virginia—French Creek, September 28. North Carolina—Reidsville, September 26. South Carolina—Huger, September 10. Georgia—Tifton, September 27. Florida—St. Marks, October 9.

Early dates of fall arrival are: District of Columbia—Washington, August 13. Georgia—Columbus, July 28. Alabama—Leighton, August 8. Florida—Key West, August 30. Mississippi—Gulfport, August 23. Texas—Cove, July 29. Tamaulipas—Matamoros, August 25. Costa Rica—Bonilla, September 8.

Banding.—Few blue-winged warblers have been banded and recovered. A bird banded at Elmhurst, Long Island, on August 17, 1935, flew into a screened porch at Westbury, Long Island, on May 7, 1937. The two places are about 15 miles apart.

Egg dates.—Connecticut: 30 records, May 25 to June 24; 20 records, May 29 to June 6, indicating the height of the season.

New Jersey: 40 records, May 16 to June 19; 29 records, May 22 to 30.

Pennsylvania: 27 records, May 28 to July 7; 14 records, May 28 to June 3 (Harris).

VERMIVORA BACHMANII (Audubon)

BACHMAN'S WARBLER

Contributed by Edward von Siebold Dingle

HABITS

Bachman's warbler was discovered by Dr. John Bachman a few miles from Charleston, S. C., in July, 1833. According to Audubon (1841), who described and named in honor of his "amiable friend" the only two specimens taken, several other birds were seen soon after in the same locality.

More than half a century passed before the bird again appeared in America, this time in Louisiana. Charles S. Galbraith (1888), while securing specimens of warblers at Lake Pontchartrain for the millinery trade in the spring of 1886, took a single bird; in the two succeeding years he collected a number of additional specimens, 6 in 1887 and 31 in 1888. These birds were evidently migrating, for the 31 were all taken between March 2 and 20, and none could be found after the end of March. Chapman (1907) comments on Galbraith's first specimen: "This specimen, now in the American Museum of Natural History, is prepared for a hat-piece. The feet are missing, the wings are stiffly distended, the head bent backward in typical bonnet pose, and, had it not been for an interest in ornithology which led Galbraith to take his unknown birds to Mr. Lawrence for identification, this *rara avis* might have become an unappreciated victim on Fashion's altar."

Since then the records have multiplied; but *bachmanii* has always been an extremely local species, even in migrations, and breeds in primeval swamps in small colonies, which are few and far between. At the present writing, the bird is one of the very rarest of North American warblers. It has been an unattained ideal to the writer; yet, having heard much about its habits from the late Arthur T. Wayne and having visited with him the former breeding grounds, he has some consolation for not having met it in life.

Wayne (1901) took a specimen of this species on May 15, 1901, near Mount Pleasant, which was the first record for South Carolina since Dr. Bachman collected the type, and says: "I am positive that I have heard this song nearly every summer in the same localities where the male was found, but I always keep out of such places after April 10 on account of the myriads of ticks and red bugs which infest them. Then, too, such places are simply impenetrable on account of the dense blackberry vines, matted with grape vines, fallen logs piled one upon another, and a dense growth of low bushes."

Spring.—From its winter home in Cuba Bachman's warbler enters the United States through Florida, and according to Howell (1932) the earliest date of arrival in that state is February 27. It has also been recorded from Louisiana on the same date (Chapman, 1907). The majority of individuals, however, cross to the United States mainland early in March; apparently the birds that summer in Alabama, Missouri, Arkansas, and Kentucky reach their breeding grounds by skirting the Gulf coast and continuing up the Mississippi Valley. They reach the vicinity of Charleston, S. C., in March and nesting begins at once, for Wayne (1907) found a nest on March 27 containing one egg and another on April 3 with five well-incubated eggs. He calls attention to the fact that Bachman's warbler therefore breeds earlier than the resident pine and yellow-throated warblers.

Nesting.—Dr. Bachman did not discover the breeding grounds of this warbler, and it was more than 60 years before the first nests and eggs became known to science; Widmann (1897) found the bird breeding in the St. Francis River country of Missouri and Arkansas on May 13, 1897. The nesting area extended "over two acres of blackberry brambles among a medley of half-decayed and lately-felled treetops, lying in pools of water, everything dripping wet with dew in the forenoon, and steaming under a broiling sun in the afternoon." The first nest, which he describes as being 2 feet from the ground, "was made of leaves and grass blades, lined with a peculiar black rootlet; it was tied very slightly to a vertical blackberry vine of fresh growth and rested lightly on another, which crossed the former at a nearly right angle. From above it was entirely hidden by branchlets of latest growth, and the hand could not have been inserted without at first cutting several vines, overlying it in different directions."

Ridgway (1897) describes this nest as, "a somewhat compressed compact mass composed externally of dried weed- and grass-stalks and dead leaves, many of the latter partially skeletonized; internally composed of rather fine weed- and grass-stalks, lined with black fibres, apparently dead threads of the black pendant lichens (*Ramalina*, species ?) which hang in beard-like tufts from button-bushes (*Cephalanthus*) and other shrubs growing in wetter portions of the western bottomlands. The height of the nest is about 3½ inches; its greatest breadth is about 4 inches, its width in the opposite direction being about 3 inches. The cavity is about 1½ inches deep and 1½×2 inches wide."

In 1906, Wayne (1907) found six nests of Bachman's warbler near Charleston, S. C., from two of which the young had flown. "The swamp in which this warbler breeds is heavily timbered and subjected to overflow from rains and reservoirs. The trees are chiefly of a deciduous character, such as the cypress, black gum, sweet gum, tupelo, hickory, dogwood, and red oak. In the higher parts of the swamp short-leaf pines, water oaks, live oaks, and magnolias abound. The undergrowth is chiefly cane, aquatic bushes, and swamp palmetto, while patches of blackberry brambles and thorny vines are met with at almost every step." The first two nests, found on April 17, are described as follows:

> The first nest was placed upon a dead palmetto leaf, being supported by a small aquatic bush, and was completely hidden by a living palmetto leaf which overhung the nest, like an umbrella. It was in a dense swamp, two feet above the ground, and contained four pure white eggs, almost ready to be hatched.
>
> The second nest, which was within one hundred yards of the first one, was built in a bunch of canes (*Arundinaria tecta*), and supported by a palmetto leaf. This nest was three feet above the ground, in a compartively dry situation, and contained four pure white eggs in an advanced stage of incubation. * * *
>
> The two nests are similar, being constructed of fine grass, cane leaves, and other leaves, the latter skeletonized. The second nest, taken April 17, is 6½ inches high, 6 inches wide, 2 inches wide at rim, and 2 inches deep. It is composed almost entirely of dead cane leaves, a little Spanish moss (*Tillandsia usneoides*), and a few skeletonized leaves. * * *
>
> The female is a very close sitter; indeed so close that I found it necessary to touch her before she would leave the nest. This habit was the same in both females.

The other nests were in low bushes, vines, or canes.

During that same year Embody (1907) discovered Bachman's warbler breeding in Logan County, Ky., and later Holt (1920) found it nesting in Autauga County, Ala. The localities in which these birds were breeding and the locations of the nests were not very different from those described above by Wayne.

Eggs.—The egg of Bachman's warbler is ovate and pure white, and usually glossy. The only spotted egg on record is one of a set described by Holt (1920) as follows: "The nest contained four eggs, three of them pure, glossy white, the other with a dozen minute dots of light brown, mostly about the large end; all were tinted faint salmon pink by the yolks." Three to five eggs constitute a set; three seem the usual number, with four a close second, while five are unusual.

[Author's Note: The measurements of 42 eggs average 15.8 by 12.4 millimeters; the eggs showing the four extremes measure **16.6** by 12.9, 16.5 by **13.0, 14.9** by 12.2, and 15.8 by **11.6** millimeters.]

Plumages.—[Author's Note: Two young birds, just able to fly from the nest and taken by Wayne on May 13, are thus described by Brewster (1905):

> The male which is now before me may be described as follows:—Top and sides of head and fore part of back faded hair brown with a trace of ashy on the middle of crown; remainder of upper parts dull olive green; wings and tail (which are fully grown) as in the first winter plumage excepting that the greater and middle wing-coverts are rather more broadly tipped with light brown, forming

two well-marked wing-bars; chin and throat brownish white tinged with yellow; sides of jugulum smoke gray, its center yellowish; sides of breast gamboge yellow shading into olive on the flanks; middle of breast, with most of abdomen, yellowish white; under tail-coverts ashy white. All the feathers on the under parts which are strongly yellow or olive, and those on the upper parts which are decidedly ashy or greenish, appear to belong to the autumnal plumage or, as it is now called, the first winter plumage, but all the other feathers on the head and body are evidently those of the first plumage. * * *

I have not seen the young female Bachman's Warbler above referred to, but Mr. Wayne writes me that "it differs from the male only in these respects: The yellow on the sides of the breast is very much paler and more restricted and the back is not greenish, but brownish. The white on the tail-feathers is merely indicated on the margins of the inner webs of the tail-feathers."

It would appear from the above that there is a sexual difference even in the juvenal plumage, and that the postjuvenal molt begins before the middle of May. This molt evidently involves all the contour plumage and the wing coverts but not the rest of the wings or the tail. The young male in first winter plumage is similar to the adult male at that season, but the crown is entirely gray, or with very little black; the feathers of the black patch on the throat, which is more restricted, are tipped with yellowish or buffy. There are no specimens available that indicate a prenuptial molt, which is probably very limited. Young males in the first nuptial plumage may be recognized by the worn and faded wings and tail.

The complete postnuptial molt of adults apparently occurs in July or earlier; I have seen no molting birds, but a large series of August birds are all in completely fresh winter plumage. In this plumage the male resembles the spring male, but the black of the crown is widely tipped with gray and the black of the breast is narrowly tipped with yellowish; these tips largely wear away before spring, although Wayne (1910) says that his "breeding males all show the olive yellow edging on the black feathers." Similar molts and changes take place in the female, but she has no black in the crown and much less or none at all on the breast; her colors are duller and she has less white in the tail, as well as olive-green, instead of yellow, lesser wing coverts.

For a full description of individual variations in plumage, the reader is referred to Mr. Brewster's (1891) excellent paper.]

Food.—Very little information is to be found concerning the food of this warbler, but insects undoubtedly constitute its diet. Howell (1924) says: "Five stomachs of this species from Alabama contained remains of caterpillars and a few fragments of Hymenoptera, probably ants."

Behavior.—Wayne (1907), in writing of this bird on its breeding grounds, says: "Bachman's Warbler is a high-ranging bird, like the Yellow-throated Warbler, and generally sings from the top of a sweet gum or cypress. It appears to have regular singing stations during the breeding season, and upon leaving a tree it flies a long distance before alighting. On this account it is impossible to follow the bird through the dark forest, and it can only be detected by its song. I have occasionally seen the males in low gall-berry bushes within six or eight inches of the ground, but their usual resorts are among the topmost branches of the tallest forest trees."

Brewster (1891) had similar experience with migrating birds in Florida:

> Nearly or quite all that has been hitherto written about this Warbler would lead one to infer that its favorite haunts are dense thickets, undergrowth, or low trees, and that it seldom ventures to any considerable height above the ground. Our experience, however, was directly contrary to this. * * * The bird, moreover, not only frequented the tops of the tallest trees, but at all times of the day and under every condition of weather kept at a greater average height than any other Warbler excepting *Dendroica dominica.* In its marked preference for cypresses it also resembled the species just named, but unlike it was never seen in pines. * * *
>
> At the time of our visit the Suwanee bottoms were alive with small birds many of which were doubtless migrants. They banded together in mixed flocks often of large size and motley composition. * * * Such a gathering was nearly certain to contain from one or two to five or six Bachman's Warblers.
>
> These with the Parulas were most likely to be feeding in the upper branches of some gigantic cypress, at least one hundred feet above the earth, where they looked scarcely larger than bumble bees. * * *
>
> The habits and movements of Bachman's Warbler are in some respects peculiar and characteristic. It does not flit from twig to twig nor launch out after flying insects in the manner of most Warblers, and many of its motions are quite as deliberate as those of a Vireo. Alighting near the end of a branch it creeps or sidles outward along a twig, and bending forward until the head points nearly straight down, inserts the bill among the terminal leaflets with a peculiar, slow, listless motion, keeping it there a second or two, and repeating the leisurely thrust many times in succession without changing its foothold. The action is like that of several other members of the genus—notably *H. pinus* and *H. chrysoptera*—under similar conditions, and suggests the sucking in of liquid food, perhaps honey or dew. Not infrequently a bird would hang back downwards beneath a twig and feed from the under sides of the leaves in the manner of a Titmouse, * * *
>
> Many of the hackberry trees along the banks of this stream contained compact bunches—nearly as large as a child's head—of dead leaves blackened by exposure to wind and weather. These bunches probably sheltered insects or their larvae, for they attracted several species of birds, especially the Bachman's Warblers which would work at them minutes at a time with loud rustling, sometimes burrowing in nearly out of sight and sending the loosened leaves floating down to the ground. Upon exhausting the supply of food or becoming tired of the spot—whether one of the leaf bunches or the extremity of a cypress branch—the bird almost invariably started on a long flight, often going hundreds of yards through the woods or crossing the river, instead of merely passing to the next branch or tree as almost any other Warbler would have done under similar circumstances. This habit seemed to us characteristic of the species.

Atkins wrote from Key West (Scott, 1890):

> Bachman's Warbler in its habits is very much like the Parula Warbler (*Compsothlypis americana*). The resemblance is more noticeable when feeding and in search of food. The birds will then penetrate a thick bunch of leaves and go through, over and all around in the most thorough manner in their exploration after insects that appeal to their taste. They are very active, and constantly in motion. They are also quarrelsome, and resent the intrusion of other species. Frequently I have noticed them fighting away the White-eyed Vireo, and where two or more Bachman's Warblers are observed together, one is pretty sure to see them chasing and fighting among themselves. When disturbed or alarmed they are at once alert; a sharp alarm note, something like that of a Yellow-throated Warbler (*D. dominica*) is uttered, but more forcible and clear cut in its delivery. This is accompanied with a few jerks of the tail, and the bird is off to a neighboring tree. They are found alike in the trees, low bushes, and shrubbery, sometimes on or quite near the ground, and seem to prefer the heavy and more thickly grown woods to trees or bushes more in the open. Young birds are quite tame, but the adults as a rule were very shy and difficult to approach after having been once disturbed.

Voice.—The song of Bachman's warbler is of a wiry or insectlike character, and has been widely compared by many observers to the music of the worm-eating and parula warblers and the chipping sparrow. It also resembles, according to Aretas A. Saunders (MS.), one of the songs of the blue-winged warbler. Brewster (1891) says:

> The song is unlike that of any other species of *Helminthophila* with which I am acquainted and most resembles the song of the Parula Warbler. It is of the same length and of nearly the same quality or tone, but less guttural and without the upward run at the end, all of its six or eight notes being given in the same key and with equal emphasis. Despite these differences it would be possible to mistake the performance, especially at a distance, for that of a Parula singing listlessly. The voice, although neither loud nor musical, is penetrating and seems to carry as far as most Warblers'. Besides the song the only note which we certainly identified was a low hissing *zee-e-eep*, very like that of the Black-and-white Creeper.

Widmann (1897), observing a singing male for 8 hours, says that "the bird kept singing nearly all the time at the rate of ten times a minute with the regularity of clockwork, and its sharp, rattling notes reminded me strongly of an alarm-clock. In this regard it recalls one of the performances of Parula, whose rattle is of the same length and quality, except that it has a certain rise at the end, by which it is easily distinguished."

Wayne (1910) heard one singing exactly like a prothonotary warbler, this song lasting for more than 20 minutes. And Howell (1924) mentions two Bachman's warblers, observed in Alabama, that "had the habit of singing on the wing, the song being delivered just before the bird alighted on a perch after a short flight."

Field marks.—[AUTHOR'S NOTE: Under certain circumstances Bachman's warbler might be mistaken for a black-throated green warbler, but, fortunately, the two species do not frequent similar habitats at the same seasons. Mr. Brewster (1891) calls attention to the difficulty of distinguishing it from the parula warbler, when the two are seen against the sky in a lofty treetop; at such times—

> the chestnut throat-markings of the Parula showed quite as dark and distinct as the black cravat of the Bachman's Warbler.
>
> The latter bird, however, was the larger or rather plumper-looking of the two, and if the upper side of the wings could be seen the absence of the white bars which are so conspicuous on the wings of the Parula Warbler was quickly noticed. * * * Of course it is only the male Bachman's Warbler which can be confounded with the Parula, for the female—setting aside occasional individuals which have black on the throat—is most like the Orange-crowned Warbler. * * * Both sexes of Bachman's Warbler habitually carry the feathers of the crown a little raised, giving the head a fluffy appearance.]

Fall.—[AUTHOR'S NOTE: Wayne (1925) says: "The Bachman's Warbler has left South Carolina before the advent of August; the latest date I have is a young male taken by me on July 16, 1919." But he records a specimen which struck the lighthouse on Tybee Island, Ga., on September 23, 1924; he thought that this bird might have come from somewhere in the Mississippi Valley region, where the species breeds much later than in South Carolina. Atkins sent the following notes to W. E. D. Scott (1890):

> Key West, Florida, 1889. First arrival from north, July 17, one adult male and one young female. Next observed July 23, three birds. Not seen again until July 31, though I was watching for them almost continually; three birds again on this date. August 4, found them more common perhaps a dozen birds in all were seen. From this time till August 25 inclusive, I found them regularly in small numbers. On August 8, 11, and 25 they were most abundant, particularly so on the first-named date, when as many as twenty-five or thirty birds were seen. After the 11th there was a decline in the numbers until the 25th, when they were again almost as numerous as on the 8th, but none were observed after the 25th.

Bachman's warbler is said to spend the winter in western Cuba and the Isle of Pines, migrating through Florida and the Keys.]

DISTRIBUTION

Range.—Southeastern United States and Cuba.

Breeding range.—Although Bachman's warbler was described more than a hundred years ago its range is still very imperfectly known. After its discovery near Charleston, S. C., in 1833, the bird remained unknown until rediscovered in 1886 near Lake Pontchartrain, La.

The first nest was found in 1897 in southeastern Missouri, nearly the northwestern border of the range as now known. It was not until 1901 that the species was again found near Charleston and in 1905 the first young birds were collected in the same swamp where the type specimen was collected.

Bachman's warbler breeds, locally **north** to northwestern Arkansas (possibly Winslow, Big Creek, and Bertig); southeastern Missouri (Grandin, Senath, and has occurred in Shannon County); central Kentucky (Russellville and Mammoth Cave); possibly occasionally in southern Indiana, since a pair was seen throughout the breeding season at Indianapolis; north-central Alabama (Irondale); and southern South Carolina (Charleston). **East** to the coastal swamps of South Carolina (Charleston), and Georgia (Savannah). **South** to Georgia (Savannah and possibly the Okefenokee Swamp); southern Alabama (Tensas River); and southern Louisiana (West Baton Rouge Parish). **West** to southeastern Louisiana (West Baton Rouge Parish) and northwestern Arkansas (Winslow, possibly). In addition, specimens have been recorded at Fayetteville, Ark.; Versailles, Ky.; Aylett, Va.; and Raleigh, N. C.

Winter range.—The only known wintering place for the Bachman's warbler is the island of Cuba. It has occurred in the Bahamas in fall migration. Color is given to the theory that this species may occasionally spend the winter in the deep swamps of Georgia and Florida, by the collection of a specimen in Okefenokee Swamp on December 30, 1928, and the occurrence of several in December of 1932. A specimen was collected at Melbourne, Fla., on January 27, 1898.

Migration.—That Bachman's warbler migrates through the Florida Keys is indicated by the large number seen at Key West in fall migration and by the many that have struck the light at Sombrero Key. On March 3, 1889, 21 birds of this species struck the light and five more were killed on April 3.

Early dates of spring arrival are: Florida—Lukens, February 27. Georgia—Atlanta, April 18. Alabama—Woodbine, March 20. Mississippi—Deer Island, March 21. Louisiana—Mandeville, February 27.

In spring the latest date at Dry Tortugas Island, Fla., is April 9 and the earliest fall arrival at Key West, Fla., July 17.

Fall departure dates are: Georgia—Savannah, September 24. Florida—Key West, September 5.

Egg dates.—Missouri: 4 records, May 13 to 17.

South Carolina: 19 records, March 27 to June 17; 10 records, March 27 to April 4.

VERMIVORA PEREGRINA (Wilson)

TENNESSEE WARBLER

Plate 14

HABITS

Alexander Wilson (1832) discovered this warbler on the banks of the Cumberland River in Tennessee and gave it the common name it has borne ever since, although it seems inappropriate to name a bird for a State so far from its main breeding range in Canada. Only two specimens were ever obtained by him, and he regarded it as a very rare species, possibly a mere wanderer from some other clime, hence the name *peregrina.* Audubon never saw more than three individuals, migrants in Louisiana and at Key West. And Nuttall, it seems, never saw it at all. Its apparent rarity in those early days was, perhaps, due to the fact that it is inconspicuously colored and might easily be overlooked or mistaken for a small plainly colored vireo or for the more common Nashville warbler; its fluctuation in numbers from year to year in different places may also have suggested its apparent rarity. Here in Massachusetts, we have found it very common in certain years and very scarce in others.

Spring.—Professor Cooke (1904) says: "In spring migration the Tennessee warbler is rarely found east of the Alleghenies, nor is it so common in the Mississippi Valley as during the fall migration." And he makes the rather surprising statement that "the Biological Survey has received no notes from the South Atlantic States on the spring migration of the Tennessee warbler, nor from Alabama, Mississippi, or Louisiana, though two birds were seen in April in Cuba and some were taken on the island of Grand Cayman, and the species has been noted several times in spring at Pensacola, Fla." Yet he gives April 26, 1885, as the date of its arrival at Rising Fawn, Ga. And H. H. Kopman (1905) writes:

> In a small lot of warblers sent Andrew Allison, in the spring of 1902, from the lighthouse on Chandeleur Island, off the southeast coast of Louisiana, was a Tennessee Warbler that had struck the lighthouse April 13. While I had some dubious records of the occurrence of the Tennessee Warbler at New Orleans in the early part of April, it was not until 1903 that I saw the species, in spring, and then in some numbers, singing, and loitering to a degree that surprised me, for the first of these transients appeared April 26, and the last was noted May 9. They were restricted almost to one spot, a thicket of willows beside a pond in the suburbs of New Orleans. I observed others the latter part of April, 1905.

This warbler seems to be a rare spring migrant through Florida; A. H. Howell (1932) gives seven records, from Key West to Pensacola, in March and April. The few records available seem to indicate that the main migration route is along the eastern coasts of Central America (Dr. Skutch tells me that he sees it both spring and fall in Costa Rica), Mexico, and Texas to the Mississippi Valley, whence it spreads out to reach its wide breeding range. Some birds may reach Florida via Cuba, and we have some evidence that it migrates across the Gulf of Mexico. It is common on the coast of Texas in spring.

Gerald Thayer wrote to Dr. Chapman (1907) that about Monadnock, N. H., the Tennessee warbler is "very rare, and seemingly irregular. It haunts blossoming apple trees, big elms, and roadside copses of mixed deciduous second growth."

At Buckeye Lake, Ohio, according to Milton B. Trautman (1940), "the daily and seasonal numbers of no warbler species fluctuated as greatly as did those of the Tennessee Warbler. During some spring migrations it was decidedly uncommon, and never more than 5 individuals were recorded in a day nor more than 35 for the spring. During other years as many as 250 individuals (May 16, 1929) were observed in a day, and more than 800 were noted during the migration. * * * The birds in spring chiefly inhabited the upper half of the taller trees of both upland and lowland wooded areas and also the upper parts of rows or groups of tall trees along the lake shore, streams, and about farmhouses."

It must have been a very common migrant in Minnesota at one time, for Dr. Roberts (1936) writes:

> Formerly, when all Warblers were more abundant than now, the little Tennessee flooded the tree-tops for a week or ten days in such numbers as to equal, if not excel, all other species put together, excepting only the Myrtle. Insignificant in size and inconspicuous in garb, it made up for these shortcomings by numbers and incessant vocal effort, indifferent performer though it is. It is still one of the commonest species. It keeps well up among the topmost branches and moves restlessly about in search of food, singing meanwhile with little apparent effort and announcing its passage from one tree-top to another by a succession of sharp little *yeap-yeaps* that are almost as characteristic to the trained ear as the song itself.

A. D. Henderson, of Belvedere, Alberta, tells me that the Tennessee warbler is probably the most numerous of the warblers which spend the summer in the territory around Belvedere and in the Fort Assiniboine District. It breeds mainly in poplar woods, but I have also found nests in dry muskeg."

Nesting.—Prior to the beginning of the present century very little authentic information on the nesting habits of the Tennessee warbler was available. Professor Cooke (1904) records two sets of eggs taken by one of the parties of the Biological Survey in 1901 at Fort Smith, Mackenzie, of which he says: "These eggs are among the first absolutely authentic specimens known to science." And Dr. Chapman

(1907) remarked: "The Tennessee Warbler awaits a biographer." Since then, we have learned much about it, mainly through the writings of B. S. Bowdish and P. B. Philipp, who found it breeding abundantly in New Brunswick. In their first paper (1916) they describe the summer haunts and the nesting habits of this warbler as follows:

> The region in question is particularly well adapted to the nesting requirements of the Tennessee Warbler, as we noted them during the above period. Extensive lumbering has removed the greater part of the large growth spruce and balsam timber, which forms the great bulk of the forests of this region, leaving areas of small trees, which, in the older clearings, have grown thickly, and to an average height of ten feet. These are interspersed with areas of more or less open, large timber, and others where the second growth has reached little more than the proportions of somewhat scattered shrubbery. The essentially level surface is frequently scored by slight depressions which form the beds of tiny streams, bordered on either side by boggy ground, dotted with grass tussocks, bushes and small trees, and overspread with a luxuriant growth of moss. Such areas are most numerous in cleared tracts, but not infrequent in the edges and the more open portions of the woods. These are the summer home-sites of the Tennessee Warbler. * * *
>
> At the time of our visit to the breeding country, in the middle of June, nest building was completed and full sets of eggs had been laid. Altogether, ten nests were located, all built on the ground in substantially the same general sort of situation, and all but two were found by flushing the bird. The nest is built in the moss, usually in a wet place at the foot of a small bush, and in most cases in woods, somewhat back from the more open part of the clearings. A hollow is dug in the moss, usually beneath an overhanging bunch of grass. The nest is in nearly every case entirely concealed and it is impossible to see it from any view-point without displacing the overhanging grass. Consequently unless the bird is flushed it would be all but impossible to find it. The outer foundation of the nest is of dry grass forming quite a substantial structure. Several nests had whisps of grass stems extending from the front rim, as noted in description of the first nest below. It is lined, usually, with fine dry grass, to which in some instances the quill-like hairs of the porcupine, or white moose hairs, are added, and more rarely still, fine hair-like roots which were not identified. * * *
>
> This species seems to be somewhat gregarious. In 1914, in one small clearing, five males were heard singing at the same time. In 1915, in the same clearing, three males were heard singing at once, and two nests were found. In almost every clearing of suitable size at least two pairs of birds were found, the nests being sometimes located rather close together. * * *
>
> On the second day of our sojourn, June 19, we visited one of the typical nesting places of this warbler, a boggy cleared swale, with scattering, small second growth, and soon flushed a female from a nest containing six fresh, or practically fresh, eggs. This nest, typical of the majority of those found in both construction and situation, was placed in the side of a small tussock, bedded in moss and completely overhung by the dead grass of the previous year's growth. The nest was composed entirely of fine, nearly white, dead grass stems. From the front rim protruded outward and downward, a wisp of dead grass tips, lying over the lower grasses in the tussock, and shingled over by the overhanging grass, establishing a continuity of the side of the tussock, thus cunningly adding to

the perfect concealment. A tiny tree and one or two bush shoots grew from the tussock, close to the nest and this feature was typical of the greater number of the nests found.

They give the measurements of four nests; the outside diameter varied from 3 to 4 inches, the inside diameter from 1⅛ to 2 inches, the outside depth from 2 to 3¼, and the inside depth from 1⅛ to 1½ inches. What nests I have seen, in collections, all appeared much flatter than the above measurements indicate, but they were probably flattened in transit. All that I have seen seemed to consist entirely of very light, straw-colored grass rather lightly arranged. Some observers mention moss in the composition of the nest, but the nests are evidently made in the moss and not of it.

Dr. Paul Harrington mentions in his contributed notes four nests that he found near Sudbury, Ontario: "The nests were all similarly situated in a clump or mound of sphagnum, well arched so that to obtain a full view of the nest it was necessary to part the sphagnum, in shaded areas on the borders of black spruce bogs. These, and others I have examined, have always been constructed entirely of fine straw-colored grasses, whereas in those of the Nashville warbler a few hairs or gold-threads were generally incorporated in the structure."

Philipp and Bowdish (1919) record in a later paper the finding of a number of additional nests in New Brunswick, and say: "The experience of the past two years has demonstrated that while the boggy ground nesting, previously described, is the really typical and by far the most common form, not a few of these birds nest on higher and dryer ground. One such nest, found June 24, 1918, was well up on a steep hillside, in rather open woods, on fairly dry ground, utterly devoid of moss and grass cover. It was built among a thick growth of dwarf dogwood, and under a tiny, crooked stemmed maple sapling, very well concealed, and was rather more substantially built than the average nest of this species."

The nesting history of the Tennessee warbler would not be complete without mentioning two authentic records made in 1901. J. Parker Norris, Jr. (1902), reported receipt of a set of four eggs, collected by Major Allan Brooks on June 15, 1901, at Carpenter Mountain, Cariboo, British Columbia. This is apparently the first authentic set of eggs ever taken, as those mentioned above by Professor Cooke were taken a few days later. In this far western locality, the birds "generally frequented the clumps of aspen trees and Norway pines, where the ground was covered with a thick growth of dry pine grass." Major Brooks found several other nests in the same locality, and says in his notes: "The nests were always on the ground, sometimes at the foot of a small service berry bush or twig. They were all arched over by the dry pine grass of the preceding year, this year's growth having just well commenced."

The Fort Smith nests, referred to by Professor Cooke, were recorded by Edward A. Preble (1908) as follows:

> Nests containing eggs were found by Alfred E. Preble on June 20 and 27, the eggs, five in number, being fresh in each instance. The first nest was embedded in the moss at the foot of a clump of dead willows near the edge of a dense spruce forest. It was rather slightly built of dead grass with a lining of the same material, and was protected from above by the overhanging bases of the willows, and by the strips of bark which had fallen from them, so that the nest could be seen only from the side. The second nest was more bulky, was composed outwardly of shreds of bark, coarse grass, and *Equisetum* stems, and was lined with fine grass. It was placed on the ground beneath a small fallen tree, in a clearing which had been swept by fire a year or two previously.

W. J. Brown, of Westmount, Quebec, tells me that he and L. M. Terrill in an hour found 16 nests of this warbler in a corner of a sphagnum bog, and, "there must have been about 100 pairs nesting in this ideal spot at the time."

Eggs.—The Tennessee warbler lays large sets of eggs, from four to seven, with sets of six common. Philipp and Bowdish (1919) state, "it appears that more full layings of six eggs are to be found than of five."

The eggs are ovate to short ovate and have only a slight luster. The ground color is white or creamy white, and the markings, in the form of speckles and small spots, are in shades of "chestnut" and "auburn," sometimes intermingled with "light vinaceous-drab." On some the markings are well scattered over the entire surface while on others they are concentrated at the large end, often forming a loose wreath. Only occasionally do the spots assume the proportions of blotches. The measurements of 50 eggs average 16.1 by 12.4 millimeters; the eggs showing the four extremes measure 17.8 by 12.7, 16.8 by 13.1, 14.8 by 12.3, and 15.8 by 11.4 millimeters (Harris).

Young.—Nothing seems to have been recorded on the period of incubation, which is performed by the female alone. Nor do we know anything about the care of the young or their development.

Plumages.—Dr. Dwight (1900) says that the young Tennessee warbler in juvenal plumage, in which the sexes are alike, is similar to the young Nashville warbler in similar plumage but lacks the brownish cast and has a faint transocular stripe. He describes it as "above dull grayish olive-green, the rump brighter. Wings and tail clove-brown, the primaries whitish edged, the secondaries, tertiaries and wing coverts greenish edged with two yellowish white wing bands. Below grayish buff rapidly fading when older to a greenish gray; abdomen and crissum pale straw-yellow. Trace of ducky transocular streak."

The incomplete postjuvenal molt, involving the contour plumage and the wing coverts, but not the rest of the wings or the tail, begins about the middle of July. This produces the first winter plumage, in which the young male is "above, bright olive-green, gray tinged on the pileum. Below, olive-yellow darker on the flanks, the abdomen and crissum white. Superciliary line and orbital ring buff. Transocular streak dull black." The young female "differs from the male in having the lower parts more washed with olive-green." Young and old birds are now practically indistinguishable.

Dickey and van Rossem (1938) say that the prenuptial molt "begins in late February and is not finished before about the middle of March. The molt involves most of the anterior body plumage, but progresses so slowly that this species never has the ragged 'pin-feathered' appearance so often seen in *Dendroica aestiva* at the spring molt." Dr. Dwight noticed the beginning of this molt as early as January 14. He says it "involves chiefly the head, chin and throat. The ashy gray cap is acquired, the chin, throat, and superciliary line become white, the throat is tinged with cream-buff and the transocular streak black. The yellow tints of the feathers retained below are lost by wear." In the female, this molt is less extensive than in the male, and "the crown never becomes, even in later plumages, as gray as that of the male, but always has a brown or greenish tinge."

Subsequent molts consist of a complete postnuptial in July and a partial prenuptial molt in late winter and early spring as in the young bird.

Food.—Bowdish and Philipp (1916) sent four stomachs of birds collected in June to the U. S. Biological Survey for analysis. One of these was empty. Of the other three, one contained 8 small caterpillars (Tortricidae), 35 percent; dipterous fragments, 23 percent; a small spider, 2 percent; and scalelike fragments (perhaps of some catkin), 40 percent. Another held a camponotid ant, 16 percent; at least 78 small caterpillars (Tortricidae), 75 percent; a snail (*Vitrea hammoides*), 4 percent; and unidentified vegetable fragments, 5 percent. The other contained 3 lampyrids (near *Podabrus*), 8 percent; a small coleopterous (?) larva, 3 percent; about 15 small caterpillars (as above), 25 percent; a neuropterous insect (apparently a caddis fly), 50 percent; 2 small spiders, 14 percent; and a trace of unidentified vegetable matter.

Several observers have complained that Tennessee warblers do considerable damage to grapes, and this is undoubtedly true. W. L. McAtee (1904), while investigating the damage done by this and the Cape May warbler, found that—

> in the arbor under observation, which was a small one, scarcely a grape and not a cluster was missed. The damage, however, was inconsiderable as the birds did not commence to use their appropriated share of the crop until the owner had taken all he desired. * * * Both species were constantly busy catching insects on the vines, and on a walnut and some appletrees near by. Frequently, however, they dashed into the vines and thrust their bills quickly

> into a grape. Sometimes they withdrew them quickly; again they poked around in the interior of the grape a little, and always after these attacks, they lifted their heads as in drinking. This action suggested a reason for piercing the grapes, that I am satisfied is the true one, that is, the obtaining of liquid refreshment.

A supply of available drinking water for the birds, might help to protect the grapes. And, as the warblers feed on insects that seriously damage the grapevines, the good work they do may compensate for the grapes that they damage. The stomach of one Tennessee warbler examined by Mr. McAtee contained a *Typhlocyba comes*, an especial pest of the grape, a destructive jassid or leafhopper, 6 caterpillars which were doing all in their power to eat up the leaves remaining on the vines, 2 spiders, a bug (*Corizus*), a weevil, and one parasitic hymenopteron (the only insect that was not harmful).

S. A. Forbes (1883) found that a stomach taken from an orchard infested by canker-worms contained about 80 percent of these destructive larvae and about 20 per cent beetles. Professor Aughey (1878) observed these warblers catching young locusts in Nebraska. Clarence F. Smith adds, in some notes sent to me, that "in the fall, during migration time, Tennessee warblers often glean their food from dense patches of such weeds as sunflower, goldenrod, and ragweed," and that "sumac, poison ivy, and other berries are sometimes eaten in small quantity."

F. H. King (1883) has considerable to say about the damage done to Delaware and Catawba grapes in Wisconsin; as soon as they are wounded, they are attacked by ants, bees, and flies and soon destroyed. But he thinks the service rendered more than compensates for the harm done. He refers to the feeding habits of the Tennessee warbler as follows:

> It is very dexterous in its movements, and obtains the greater part of its food upon and among the terminal foliage of trees. Titmouse-like, it often swings pendant from a leaf while it secures an insect which it has discovered. Small insects of various kinds, not especially attractive to larger birds, are destroyed by this species in large numbers; and its slender, acute bill serves it much better in picking up these forms than a heavier, more clumsy one could. * * * Of thirty-three specimens examined, two had eaten two very small hymenoptera (probably parasitic); seven, thirteen caterpillars; three, fifteen diptera; six, thirteen beetles; three, forty-two plant-lice, among which were two specimens of the corn plant-louse *Aphis maidis* (?); three, thirty-five small heteroptera, .09 of an inch long; and one, eleven insect eggs.

Alexander F. Skutch has sent me the following interesting notes on the feeding habits of the Tennessee warbler in Central America: "I was surprised to find last month [March] that these warblers were visiting my feeding shelf on the guava tree in the yard. About the only food I ever serve to the birds on this table is bananas and occasionally plantains; and my chief guests are tanagers of about half a dozen brilliant kinds, a few finches, honeycreepers, and wintering Baltimore orioles. But the Tennessee warblers soon formed the habit of visiting the table and sharing the food with the bigger resident birds.

Some seemed to linger in the vicinity much of the day, making frequent visits to the board and each time eating liberal portions of banana or the somewhat harder ripe plantain. They were intolerant of each other, and one individual would not let a second alight on the board until it had finished its own meal, although there was plenty of room and plenty of food for all. I have noticed also that the Tennessee warblers chase each other as they forage among the trees in wintering flocks. I cannot recall ever having seen any other wood warbler eat banana.

"Last November 14 a Tennessee warbler behaved most surprisingly. The grass in the yard had grown very long, and I had it cut with a machette. Late in the afternoon, after the usual rain, a lone Tennessee warbler flew down on the fallen grass and began to hop over it, catching small insects.

"It also entered the uncut grass, about a foot high, and disappeared momentarily amidst it. Twice driven up by passing people, each time it promptly returned to the grass. Its third visit to the cut grass was longest. While I stood quietly watching, it hopped deliberately about, much in the manner of a house wren, and gathered an abundant harvest from the fallen herbage. Once it found a caterpillar about an inch long, which it carefully bruised in its mandibles before swallowing it. The warbler was amazingly bold, and hopped over the grass within a yard of my feet, and allowed me to follow closely as it moved away. Early the following morning, and again at the close of the day, the warbler foraged over the lawn in the same fashion. In the evening, it continued to creep slowly over the mown grass and after all other birds had disappeared into their roosts, and the light was becoming too dim to see it clearly."

Behavior.—Much of the behavior of the Tennessee warbler has been mentioned above, and there is little more to be said. It is a very close sitter on its nest, when incubating, and has been caught there by throwing a hat or a net over it; but, when flushed, it is rather shy about returning to it, usually making its demonstrations of protest by flitting about at a safe distance and nervously uttering a sharp *chip*.

The Prebles (1908) witnessed a rather remarkable flight behavior at Fort Resolution, Mackenzie:

> During the forenoon of June 25, an extremely windy day, we observed a remarkable movement of these warblers. They came from the northward, flying over the point of land on which the fort is built in loose flocks of from 10 to 20 individuals. After passing the point, they either struck out directly across the bay or skirted the shore, in either case having to face a strong southeast wind. Some paused a few moments among the low bushes on the point, but the slightest

alarm started them off. The flight lasted over two hours, and, during this time, upward of 300 birds were seen from our camp. Two specimens, a male and a female, were collected. The ovaries of the female contained eggs only slightly developed.

Voice.—Aretas A. Saunders contributes the following: "The song of the Tennessee warbler is a rapid series of short, loud, unmusical notes. It has been compared to the song of the chipping sparrow, but it varies more in pitch, time, and loudness, and is distinctly in two or three parts. To my ear it is much more like the chippering of a chimney swift.

"In 35 records of this song, the number of notes varies from 9 to 25, the average being 17. Only one song has a true trill in it, that is, notes so rapid that they cannot be counted. Each song is of either two or three parts, each part composed of a series of notes on the same pitch and in uniform rhythm. The parts differ from each other in pitch, time, or loudness. In a number of songs, one of the parts is a repetition of 2-note phrases. Loudness generally increases to the end of the song, but sometimes the reverse is true. Some songs rise in pitch to the end and others fall; my records are about evenly divided in this matter. A typical three part song would be something like

tit it it it it it it pita pita pita pita pita chit chit chit chit chit.

"Pitch varies from G''' to E'''', or four and a half tones. Single songs vary from half a tone to three and a half tones, averaging one and a half. The length of songs varies from 1⅘ to 3⅕ seconds. An individual bird may sing a dozen different variations of the song in a short time. On the other hand, I have heard three birds in one tree singing alternately, the songs of all three being exactly alike so far as my ear could determine."

Francis H. Allen gives me his impression of the song as follows: "The song bears some resemblance to that of the Nashville warbler, but is easily distinguished. I have written it

wi-chip wi-chip wi-chip wi-chip, wi-chip wi-chip chip chip chip chip chip chip chip.

The higher notes in the middle sometimes appear to be monosyllables, and they are sometimes omitted. The series of *chips* at the end are very emphatic, and the last one is perhaps accented somewhat. All the notes are staccato."

Various other renderings of the song have appeared in print, but they all give the same impression of a variable, loud, striking song which, once learned, can be easily recognized. The bird is a very persistent singer rivaling the red-eyed vireo in this respect. Bowdish and Philipp (1916) write: "As a basis for estimating the frequency of song repetition, counts were kept on three singing birds for a period of 5 minutes each, with a result of 32, 36, and 22 songs, respectively, within the period. In one instance, a bird was observed to sing while on the wing, repeating the song twice in the course of a short flight." Albert R. Brand (1938) found the pitch of the Tennessee warbler's song to be well above the average, the approximate mean count being 6,600 vibrations per second, the highest note about 9,150 and the lowest 4,025; this compares with an approximate mean of 8,900 vibrations per second for the black-poll warbler, and about 4,000 for the average passerine song.

Field marks.—The Tennessee warbler has no prominent wing-bars and no very conspicuous field marks. It might be mistaken for one of the small vireos, but its bill is much more slender and acute. The male has a gray crown, a light line over the eye, and a dusky line through it; the upper parts are bright olive-green and the under parts grayish white. The female has a greener crown and more yellowish under parts. For more details, see the descriptions of plumages.

Fall.—The fall migration starts early in August, but is quite prolonged, many birds lingering in the northern States until early in October and in the southern States all through that month. During some seasons and at certain places the Tennessee warbler is exceedingly abundant, sometimes far outnumbering any other species, but it is very variable in its abundance.

Mr. Trautman (1940) says that at Buckeye Lake, Ohio, "during some years not more than 20 individuals could be recorded in a day in the southward migration, nor more than a 100 in the season. In other years the bird rivaled the Myrtle Warbler in numbers, and as many as 1,000 individuals could be seen in a day and several thousands during a migration. * * * Throughout the southward migration the species did not confine itself to the upper sections of the taller trees as in spring, but was found in almost equal numbers in smaller trees and brushy thickets, in bushes and saplings along fence rows, and in weedy fields."

Professor Cooke (1904) says of the fall migration route: "The principal line of migration is from the Mississippi Valley across the Gulf of Mexico to Mexico and Central America. The eastern part of this route probably extends from the southern end of the Alleghenies across northwestern Florida to the coast of Yucatan and Honduras." A. H. Howell (1932), however, gives several records for central and southern Florida, and says: "In autumn, Weston reports a large migration on October 26 and 27, 1925, when 31 birds were killed at the lighthouse near Pensacola on the two nights, and large numbers seen on the morning of October 26 in vacant lots in the city."

Dickey and van Rossem (1938) say of the migration in El Salvador:

> During the fall migration of 1925, Tennessee warblers arrived in the vicinity of Divisadero on October 13. No advance guard, that is, individuals arriving

ahead of the main flights, was observed in this case. On the above-mentioned date they were suddenly found to be present in numbers, and from then on were common in every lowland or foothill locality visited. In point of relative abundance this was by far the most common warbler (resident or migratory) throughout the coastal plain and in the foothills, but it was greatly outnumbered by *Dendroica virens* above 3,000 feet.

The manner of occurrence was usually as small flocks of six or eight or even twenty or more birds. These combined with several other species to make up larger flocks which worked ceaselessly through the crown foliage of low, semi-open woodland. However, many were found even in the tall, dense swamp forests along the coast and also in the oak woods on Mt. Cacaguatique.

Winter.—Dr. A. F. Skutch has contributed the following account: "The Tennessee warbler winters in Central America in vast numbers. Coming later than many other members of the family, the first individuals appear in mid-September; but the species is not abundant or widely distributed until October. During the year I passed on the Sierra de Tecpán in west-central Guatemala a single Tennessee warbler appeared in the garden of the house, at 8,500 feet, on November 7 and despite frosty nights lingered into December. On November 19, 1935, I saw one on the Volcán Irazú in Costa Rica at 9,200 feet—the highest point at which I have a record of the species. At the other extreme I found a few of these adaptable birds among the low trees on the arid coast of El Salvador in February and among the royal palms at Puerto Limón, on the humid coast of Costa Rica, in March. But Tennessee warblers are most abundant as winter residents at intermediate altitudes, chiefly between 2,000 and 6,000 feet above sea-level. From 3,000 to 5,000 feet they often seem to be the most abundant of all birds during the period of their sojourn. They travel in straggling flocks and form the nucleus of many of the mixed companies of small, arboreal birds. At times 'myriads' is the only term that seems apt to describe their multitudes.

"I think 'coffee warbler' would be a name far more appropriate than Tennessee warbler for this plainly attired little bird; it was merely a matter of chance that Alexander Wilson happened to discover the species in Tennessee rather than at some other point on its long route from Canada to Central America; but the warblers themselves manifest a distinct partiality to the coffee plantations. The open groves formed by the shade trees, whose crowns rarely touch each other, yet are never far apart, seem to afford just the degree of woodland density that they prefer. It matters not whether these trees are Grevilleas from Australia with finely divided foliage, or Ingas with large, coarse, compound leaves, or remnants of the original forest—a mixture of many kinds of trees with many types of foliage: from Guatemala to Costa Rica the Tennessee warblers swarm in the coffee plantations during the months of the northern winter and are often the most numerous birds of any species among the shade trees. Possibly they may at certain times and places be as multitudinous in the high forest as in the plantations. Although I have never found them so, the negative evidence must not be allowed to weigh too heavily, for such small, inconspicuous birds, devoid of bold recognition marks, are not easy to recognize among the tops of trees over a hundred feet high.

"Tennessee warblers are fond of flowers, especially the clustered heads of small florets of the Compositae and Mimosaceae, and of the introduced Grevillea that sometimes shades the coffee plantations. They probe the crowded flower clusters, perhaps seeking small insects lurking there rather than nectar. The white, clustered stamens of the Inga—the most generally used shade tree of the coffee plantations—are especially attractive to them. Local movements within their winter range appear to be controlled by the seasonal abundance of flowers. So, in the valley of the Río Buena Vista in southern Costa Rica, at an altitude of about 3,000 feet, I found Tennessee warblers very abundant during December and January. Here they flocked not only in the forest and among the shade trees of the little coffee groves, but also in great numbers through the second-growth thickets that filled so much of the valley, where at this season there was a profusion of bushy composites with yellow or white flowerheads, and of acacia-like shrubs (*Calliandra portoricensis*) with long, clustered, white stamens. But during February, the third dry month, the thickets became parched and flowered far more sparingly. Now the Tennessee warblers rapidly declined in numbers, and before the end of the month disappeared from the valley. During the following year, which in its early quarter was far wetter, a number remained through March, and a few well into April.

"Tennessee warblers pluck the tiny, white protein corpuscles from the brown, velvety bases of the long petioles of the great-leafed Cecropia trees, taking advantage of these dainty and apparently nutritious tid-bits when the usual Azteca ants fail to colonize the hollow stems; for only on trees free of ants does this ant-food accumulate in abundance.

"While the Tennessee warbler departs during February from some districts where it is common in midwinter, it remains until April in regions where the dry season is not severe. After the middle of April it is only rarely seen in Central America; and there appears to be no record of its occurrence in May."

DISTRIBUTION

Range.—Canada to northern South America.

Breeding range.—The Tennessee warbler breeds north to southwestern Yukon (Burwash Landing and the Dezadiash River); southern Mackenzie (Mackenzie River below Fort Wrigley, lower

Grandin River, and Pike's Portage); northeastern Manitoba (Churchill and York Factory); central Quebec (Fort George, Lake Mistassini, and Mingan); and possibly southern Labrador (Hawkes Bay). **East** to southeastern Labrador (Hawkes Bay); central Newfoundland (Lamond and Gaff Topsail). **South** to central Newfoundland (Gaff Topsail); Nova Scotia (Wolfville); southern New Brunswick (Grand Manan); northern and central western Maine (Mount Katahdin, Livermore, and Lake Umbagog); north-central New Hampshire (Mount Washington); south-central Vermont (Rutland); possibly northwestern Massachusetts (Hancock); southern New York (Slide Mountain); southern Ontario (Ottawa, North Bay, and Biscotasing; probably occasionally farther south); west-central Michigan (Duck Lane); probably northern Wisconsin (Plum Lake); northern Minnesota (Tower, Cass Lake, and Warren); southwestern Manitoba (Margaret and Aweme); central Saskatchewan (Emma Lake; has been found in the breeding season at Indian Head, Old Wives Creek, and Maple Creek); southern Alberta (Flagstaff, Red Deer, and Banff); and south-central British Columbia (150 Mile House and Kimquit). **West** to western British Columbia (Kimquit, Hazelton, Telegraph Creek, and Atlin); and southwestern Yukon (Dezadiash River and Burwash Landing).

Winter range.—In winter the Tennessee warbler is found **north** to central Guatemala (Volcán de Santa María, Cobán, and Gualán). **East** to eastern Guatemala (Gualán); northeastern El Salvador (Mount Cacaguatique); eastern Nicaragua (Río Escondido); eastern Costa Rica (Puerto Limón); eastern Panamá (Barro Colorado and Permé); northern Colombia (Santa Marta region); and northern Venezuela (Caracas). **South** to northern Venezuela (Caracas and Mérida); and northwestern Colombia (Concordia). **West** to western Colombia (Concordia and Antioquia); Panamá (Paracaté); Costa Rica (El General and Liberia); El Salvador (Puerto de Triunfo); and Guatemala (Tecpán and Volcán de Santa María). It has also been found to the first of January (possibly delayed migration) at Knoxville (1936) and at Nashville (1935), Tenn.; and one wintered (1934–35) in Cameron County, Tex.

Migration.—Late dates of departure from the winter home are: Colombia—Miraflores, April 19. Costa Rica—San Isidro del General, April 30. El Salvador—San Salvador, April 25. Guatemala—Livingston, April 8. Chiapas—Tixtla Gutiérrez, May 8. Tamaulipas—Gómez Farías, April 27.

Early dates of spring arrival are: Cuba—Habana, April 8. Florida—Sandy Key, April 13. Georgia—Athens, April 13. District of Columbia—Washington, May 2. West Virginia—French Creek, April 20. Pennsylvania—McKeesport, April 27. New York— Corning, May 3. Massachusetts—Northampton, May 8. Maine—Waterville, May 11. New Brunswick—Petitcodiac, May 19. Quebec—Quebec, May 19. Louisiana—Avery Island, April 6. Arkansas—Winslow, April 8. Tennessee—Memphis, April 9. Kentucky—Bowling Green, April 19. Indiana—Bloomington, April 12. Ohio—Columbus, April 25. Michigan—Ann Arbor, April 21. Ontario—Ottawa, May 12. Missouri—Columbia, April 22. Iowa—Sigourney, April 25. Wisconsin—St. Croix Falls, April 25. Minnesota—Clarissa, April 30. Kansas—Winfield, April 19. Nebraska—Red Cloud, April 18. South Dakota—Vermillion, May 1. North Dakota—Fargo, May 1. Manitoba—Margaret, May 3. Colorado—Estes Park, May 14. Wyoming—Torrington, May 12. Montana—Great Falls, May 9. Alberta—Belvedere, May 1. British Columbia—Carpenter Mountain, Cariboo, May 15; Atlin, May 26.

Late dates of spring departure of transients are: Cuba—Habana, May 5. Florida—Fort Myers, May 15. Alabama—Melville, May 3. Georgia—Athens, May 7. North Carolina—Chapel Hill, May 3. Virginia—Falls Church, June 3. District of Columbia—Washington, June 3. Pennsylvania—Warren, May 30. New York—Rochester, June 6. Massachusetts—Beverly, June 3. Vermont—Wells River, June 5. Louisiana—Shreveport, May 15. Mississippi—Oxford, May 15. Arkansas—Delight, May 20. Tennessee—Nashville, May 21. Illinois—Lake Forest, June 3. Ohio—Toledo, June 5. Michigan—Houghton, June 7. Ontario—Toronto, June 7. Missouri—Columbia, May 31. Iowa—Sioux City, June 6. Wisconsin—Racine, June 4. Minnesota—St. Paul, June 1. Kansas—Lawrence, May 24. Nebraska—Omaha, May 28. South Dakota—Faulkton, June 5.

Late dates of fall departure are: British Columbia—Atlin, July 26; 16-mile Lake, Cariboo, August 28. Alberta—Glenevis, September 13. Montana—Fortine, September 11. Wyoming—Laramie, October 5. Saskatchewan—Wiseton, September 29. Manitoba—Aweme, October 3. North Dakota—Fargo, October 8. South Dakota—Arlington, October 8. Nebraska—Lincoln, October 14. Kansas—Lawrence, October 22. Oklahoma—Fort Sill, October 19. Minnesota—Hutchinson, October 11. Wisconsin—Madison, October 19. Iowa—National, October 17. Missouri—St. Louis, October 19. Michigan—Ann Arbor, October 30. Ontario—Port Dover, October 10. Ohio—Columbus, October 31. Illinois—Evanston, October 28. Tennessee—Nashville, October 23. Arkansas—Jonesboro, October 19. Louisiana—New Orleans, November 8. Mississippi—Gulfport, November 12. Quebec—Montreal, September 28. Vermont—Wells River, September 29. Massachusetts—Harvard, October 1. New York—Rhinebeck, October 14. Pennsylvania—Beaver, October 26. District of Columbia—Washington, October 22. North Carolina—Mount Mitchell, October 1.

Georgia—Dalton, October 30. Alabama—Birmingham, October 25. Florida—Pensacola, November 4. Cuba—Habana, November 10.

Early dates of fall arrival are: Wyoming—Laramie, August 28. South Dakota—Lennox, August 30. Kansas—Topeka, August 29. Wisconsin—Delavan, August 19. Illinois—Glen Ellyn, August 17. Missouri—Monteer, August 20. Ohio—Toledo, August 19. Tennessee—Knoxville, September 15. Arkansas—Hot Springs, September 19. Louisiana—Monroe, September 14. Mississippi—Gulfport, September 5. Vermont—Woodstock, August 22. Massachusetts—Lexington, August 11. Pennsylvania—Jeffersonville, August 27. District of Columbia—Washington, August 31. Virginia—Salem, August 23. North Carolina—Blowing Rock, September 1. Georgia—Atlanta, September 9. Alabama—Leighton, September 17. Florida—Fort Myers, September 20. Cuba—Habana, October 13. Guatemala—Huehuetenango, September 11. Nicaragua—Río Escondido, October 24. Costa Rica—San José, September 17. Panamá—New Culebra, October 24. Colombia—Santa Marta Region, October 14.

Casual records.—In 1898 an adult male of this species was found dead at Narssag, Greenland. In Bermuda one was seen on March 2, 1914, and it remained about six weeks.

Egg dates.—Alberta: 6 records, June 1 to 16.

New Brunswick: 82 records, June 10 to July 10; 46 records, June 17 to 26, indicating the height of the season.

Quebec: 30 records, June 8 to 29; 21 records, June 17 to 27.

VERMIVORA CELATA CELATA (Say)

EASTERN ORANGE-CROWNED WARBLER

HABITS

The type race of the orange-crowned warbler makes its summer home in northwestern Canada and Alaska, from northern Manitoba to the Kowak River, migrating in the fall southeastward through the United States to its winter range in the southern Atlantic States and Gulf States, from South Carolina and Florida to Louisiana. It was discovered and named by Say (1823) early in May at Engineer Cantonment, on the Missouri River, while on its northward migration.

The main migration route is through the Mississippi Valley, northwestward in the spring and southeastward in the fall. It is very rare in spring in the northern Atlantic States, though there are a few records for even Rhode Island and Massachusetts, but there are many fall records for this region, some of them remarkably late. It seems to be rare at either season in Ohio; Milton B. Trautman (1940) gives only 10 records for Buckeye Lake, 5 in spring and 5 in fall. "Eight were noted in lowlands, within 10 feet of the ground, in dense tangles of blackberry bushes, rosebushes, or grapevines. The remaining 2, both fall birds, were in rather well-drained, brushy, and weedy fields."

Dr. E. W. Nelson (1887) says of its status in Alaska:

> Throughout the wooded region of Northern Alaska, from the British boundary line west to the shores of Bering Sea, and from the Alaskan range of mountains north within the Arctic Circle as far as the tree-limit, this species is a rather common summer resident. It is known along the shores of Bering Sea and Kotzebue Sound mainly as an autumn migrant, as it straggles to the southward at the end of the breeding season. Wherever bushes occur along the northern coast of the Territory it is found at this season, and at Saint Michaels it was a common bird each summer from the last of July up to about the middle of August, after which it became rare and soon disappeared. I have never noted it on the sea-coast during the spring migration.

The Prebles (1908) found it well distributed and probably breeding throughout the Athabaska–Mackenzie region. MacFarlane (1908) found it breeding as far north as the Anderson River. Kennicott, according to Baird, Brewer, and Ridgway (1874), found it nesting about Great Slave Lake. And Ernest Thompson Seton (1891) reported it as a common summer resident and breeding near Carberry, Manitoba.

Nesting.—Herbert Brandt (1943) found two nests of the eastern orange-crowned warbler along the Yukon River in Alaska, about 20 miles up from the sea, on July 1, 1924. His first nest contained five eggs, advanced in incubation. The nest was near the bank of the river, "in a bush 18 inches from the ground. The nest was loosely made of coarse grass held together with bark strips, silvery plant down, and a few feathers, one of which was a mottled feather of the Northern Varied Thrush. Twenty feet away was another nest of the same species, which held three young just hatched and two pipped eggs. * * * The measurements of the two nests cited are: height, 2.25 to 3.00; outside diameter, 3.5; inside diameter, 1.75; and depth of cup, 1.50 to 1.75 inches."

MacFarlane's (1908) nests, found on the Anderson River, "held from four to six eggs each, and they were made of hay or grasses lined with deer hair, feathers and finer grasses, and were usually placed in a shallow cavity on the ground in the shade of a clump of dwarf willow or Labrador tea."

Baird, Brewer, and Ridgway (1874) write:

> The nests of this species, seen by Mr. Kennicott, were uniformly on the ground, generally among clumps of low bushes, often in the side of a bank, and usually hidden by the dry leaves among which they were placed. He met with these nests in the middle of June in the vicinity of Great Slave Lake. They were large for the size of the bird, having an external diameter of four inches, and a height of two and a half, and appearing as if made of two or three distinct

fabrics, one within the other, of nearly the same materials. The external portions of these nests were composed almost entirely of long, coarse strips of bark loosely interwoven with a few dry grasses and stems of plants. Within it is a more elaborately interwoven structure of finer dry grasses and mosses. These are softly and warmly lined with hair and fur of small animals.

E. A. Preble (1908) reported a nest found near Fort Resolution that "was placed among thick grass on a sloping bank, and was composed outwardly of grass and *Equisetum* stems, with a layer of finer grass and with an inner lining of hair."

Several nests have been reported from points farther south as being of this warbler, but these are probably all referable to the Rocky Mountain subspecies *Vermivora celata orestera.*

Eggs.—The orange-crowned warbler lays from 4 to 6 eggs to a set, probably most often 5. Dr. Brandt (1943) describes his Alaska eggs as follows: "The egg is short ovate in outline, the surface moderately glossy, and the shell delicate. The ground color is white and is prominent because the markings obscure but one-fifth of its area. These spots are very small, and are peppered over the broad end in an ill-defined wreath, while over the smaller two-thirds the egg is almost immaculate. In color the markings range from hydrangea red to ocher red; and underlying these are a few weak spots of deep dull lavender." Probably a series of the eggs would show all the variations shown in eggs of the other races. The measurements of 50 eggs, including those of the Rocky Mountain race, average 16.2 by 12.7 millimeters; the eggs showing the four extremes measure 18.3 by 13.2, 17.0 by 14.2, and 14.7 by 12.2 millimeters (Harris).

Plumages.—Dr. Dwight (1900) describes the juvenal plumage as "above, brownish olive-green. Wings and tail olive-brown, broadly edged with bright olive-green, the median and greater coverts tipped with buff. Below, greenish buff paler and yellower on abdomen and crissum. Lores and auriculars grayish buff."

The first winter plumage is acquired by a postjuvenal molt that involves the contour plumage and the wing coverts but not the rest of the wings or the tail. The sexes are alike in the juvenal plumage and much alike in all plumages, except that the female is always duller; in her first winter plumage the orange crown is lacking, and it is more or less suppressed and sometimes wholly lacking in subsequent plumages. Dr. Dwight (1900) describes the young male in first winter plumage as "above, bright olive-green, mostly concealed on the pileum and nape with pale mouse-gray edgings that blend into the green. The crown brownish orange concealed by greenish feather tips. Wing coverts broadly edged with dull olive-green, sometimes the greater coverts with faint whitish tips. Below, pale olive-yellow, grayish on the chin and sides of neck with very indistinct olive-gray streaking.

A dusky anteorbital spot. Lores, orbital ring and indistinct superciliary stripe mouse-gray."

The first nuptial plumage is acquired by a partial prenuptial molt, "which involves chiefly the anterior part of the head and the chin. A richer, half concealed, orange crown patch is acquired; the lores and adjacent parts become grayer, the anteorbital spot darker. Wear makes birds greener above and slightly yellower below. Young and old become practically indistinguishable."

Subsequent molts consist of a complete postnuptial molt in summer and a partial prenuptial molt in early spring, as described above. The adult winter plumage "differs chiefly from first winter dress in possessing a larger, more distinct crown patch," in the male, and more or less of it in the female. "The color below is uniform and paler."

Food.—Nothing seems to be known about the summer food of the orange-crowned warbler, but it probably does not differ greatly from that of the lutescent warbler, whose food has been more thoroughly studied. In winter, it probably eats a fair proportion of berries and other fruits, especially when it spends the winter somewhat farther north than insects are to be found in abundance. It has also been known to come to a feeding station and eat suet, peanut butter, and doughnuts. In summer, it is probably almost wholly insectivorous. I can find no evidence that it does any damage to grapes or other cultivated fruits on its fall migration.

Voice.—Ernest Thompson Seton (1891) says of an orange-crowned warbler that he shot in Manitoba on May 12, 1883: "It was flitting about with great activity among the poplar catkins, and, from time to time, uttering a loud song like '*chip-e chip-e chip-e chip-e chip-e.*' On May 14 I shot another Orange-crowned Warbler. Its song is much like that of the Chipping Sparrow, but more musical and in a higher key. The bird is extremely restless and lively, moving about continually among the topmost twigs of the trees and uttering its little ditty about once in every half minute."

Dr. Lynds Jones wrote to Dr. Chapman (1907): "The song is full and strong, not very high pitched, and ends abruptly on a rising scale. My note book renders it *chee chee chee chw' chw'*. The first three syllables rapidly uttered, the last two more slowly. One heard late in the season sang more nearly like Mr. Thompson's description: *chip-e*, *chip-e*, *chip-e*, *chip-e*, *chip-e*, but with the first vowel changed to *e*, thus eliminating what would appear to be a marked similarity to the song of Chippy. Even in this song the ending is retained."

Francis H. Allen tells me that this warbler "has a *chip* note suggesting that of the tree sparrow but sharper."

Field marks.—The orange-crowned warbler is a plain bird, with practically no white markings in wings or tail, clad in dusky olive-green, paler below, the underparts sometimes obscurely streaked with olive-gray. The brownish orange crown patch is usually not conspicuous, except in worn summer plumage, and lacking in young birds and some females.

Fall.—Orange-crowned warblers begin to leave northern Alaska in August. Dr. Nelson (1887) says that it is rare about St. Michael after the middle of the month, his latest date being August 24. The birds obtained at that season were mainly young of the year. "In fall this species frequents the vicinity of dwellings and native villages, where it searches the crevices of the fences and log houses for insects."

The southeastward migration through central Canada and the United States seems to be leisurely and quite prolonged, mainly in September and early October, but often continuing into November. In Massachusetts, there are numerous late fall records and some winter records. Horace W. Wright (1917) has published an extensive paper on this subject and has collected the following Massachusetts records: "Mr. Brewster's eleven records lie within the period of autumn from September 23 to November 28. There are three for September, namely, the 23rd and the 30th twice; none for October; and eight for November, namely, 7th, 9th, 10th, 17th, 20th–21st, 23rd–24th, 25th, and 28th. On two occasions two birds were present, November 9 and 28. My own records run later. The earliest is November 5, and the latest is January 23. They are November 5, 18, 20, 22, 28, 29, January 10, 19, 23." As Mr. Wright's records cover a period of 8 years ending with January 1916, they indicate that the orange-crowned warbler is not such a rare straggler in Massachusetts as is generally supposed, and may be looked for almost any year in late fall, or even winter. Mr. Forbush (1929) says of its occurrence there:

> This warbler may be found almost anywhere in New England during the fall migration wherever there are trees and shrubbery. In my experience the bird has been either in the trees or in the tops of rather tall shrubs and never very high, but like other members of the genus, though it nests on the ground it is said to spend considerable time in the upper parts of trees. It seems fond of the edges of woodlands near water, but it also frequents open woods, orchards, fruit gardens and shade trees, where amid the foliage it is very seldom noticed by the ordinary observer. When approached it divides its attention between the observer and its insect prey, which it hunts assiduously in the manner of others of the genus. This warbler may be seen rarely in small companies, but more often singly or in company with a small group of warblers of other species.

Dr. Winsor M. Tyler contributes the following: "The orange-crowned warbler is a rare bird in New England, but we may look for it with some hope of success in the very late autumn, through November and even into December, during the soft, calm days of Indian Summer. As we walk along over the dead leaves, wet from last night's frost, watching for the bird in the shrubs by the roadside and in neglected pastures, almost the only sound is the ticking of the falling leaves as they hit against the branches; and mistiness is all about us. Several seasons may pass before we hear its sharp *chip*, which stands out clearly from the gentle voice of the late-lingering myrtle warblers, and see it flitting all alone among the twigs, or on the ground—a lonely, dark, obscure little bird, darker and more deliberate than the kinglets. It is strange that a *Vermivora* should linger here with winter so near at hand, but indeed there is evidence which leads us to believe that a few of these warblers may attempt to spend the winter in the southern part of this region, and should any one of them withstand the cold season, it may furnish, when it moves northwards towards its breeding ground, one of the exceedingly rare instances of the occurrence of the bird on the northern Atlantic coast in spring."

Winter.—The principal winter home of the orange-crowned warbler seems to be in the southern Atlantic and Gulf States. Of its occurrence in coastal South Carolina, Arthur T. Wayne (1910) writes:

> My earliest date for its arrival is October 30, 1897, but it is never abundant until the middle of November, remaining until the second week in April. It is capable of enduring intense cold. I have seen numbers of these highly interesting birds near Charleston when the thermometer ranged as low as 8° above zero and it is always more active and hence oftener seen when the weather is cold and cloudy.
>
> The Orange-crowned Warbler inhabits thickets of lavender and myrtle bushes as well as oak scrub, and its center of abundance is on the coast islands, the greater part of which is veritable jungle, in which it particularly delights. Its only note while it sojourns here is a *chip* or *cheep* which very closely resembles the note of the Field Sparrow in winter.

Dr. Chapman (1907) says: "During the winter I have found the Orange-crowned Warbler a not uncommon inhabitant of the live-oaks in middle Florida where its sharp *chip* soon becomes recognizable. In Mississippi, at this season, Allison (MS.) says that 'its favorite haunts are usually wooded yards or parks, where the evergreen live oak and magnolia can be found; I have seen it most commonly among the small trees on the border of rich mixed woods, above an undergrowth of switch cane. Coniferous trees it seems not to care for, though I have seen it in the cypress swamps.' "

DISTRIBUTION

Range.—From Alaska and northern Canada to Guatemala.

Breeding range.—The orange-crowned warbler breeds **north** to northcentral Alaska (Kobuk River and Fort Yukon; a specimen has been collected near Point Barrow); northern and western Mackenzie (Fort McPherson, Fort Anderson, Lake Hardisty, and Hill Island Lake); northern Saskatchewan (near Sand Point, Lake Athabaska);

northeastern Manitoba (Churchill and York Factory); and casually to northwestern Quebec (Richmond Gulf). **East** to eastern and southern Manitoba (York Factory, Winnipeg, and Aweme); southwestern Saskatchewan (East End and the Cypress Hills); southeastern Alberta (Medicine Hat); western Montana (Great Falls, Belt, and Bozeman); northwestern and southeastern Wyoming (Yellowstone Park and Laramie); central Colorado (Denver, Colorado Springs, Wet Mountains, and Fort Garland); central New Mexico (Taos Mountains and Willis); and southwestern Texas (Guadalupe Mountains). **South** to southwestern Texas (Guadalupe Mountains); south-central New Mexico (Capitan Mountains); southeastern and northwestern Arizona (Tucson, Santa Catalina Mountains, and north rim of the Grand Canyon); southern Nevada (St. Thomas); and southern California (Panamint Mountains, San Bernardino Mountains, San Jacinto Mountains, Coronado Beach, and San Clemente Island). **West** to the Pacific coast of California (San Clemente and Santa Rosa Islands, Santa Barbara, San Francisco, and Eureka); Oregon (Coos Bay and Tillamook); Washington (Cape Disappointment, Stevens Prairie, and Neah Bay); British Columbia (Nootka Sound and the Queen Charlotte Islands); and Alaska (Sitka, Yakutat, Nushegak, Igiak Bay, St. Michael, and the Kobuk River).

The orange-crowned warbler has been recorded in migration in southern Quebec as far east as Metamek and may occasionally breed. There is a single breeding record for Minnesota at Cambridge.

Winter range.—The orange-crowned warbler winters **north** to northwestern Washington (Seattle); central California (Marysville, Bigtrees, Atwater, and Victorville); southern Nevada (near Searchlight); central and southeastern Arizona (Fort Verde, Phoenix, and Tucson); southern Texas (El Paso, Fort Clark, and Boerne); Louisiana (Monroe); rarely Tennessee (Memphis); central Georgia (Macon and Augusta); and southern South Carolina (Charleston). It has also occurred occasionally in winter as far north as Madison, Wis.; Ann Arbor, Mich.; Canandaigua, N. Y.; and Boston, Mass. **East** to South Carolina (Charleston); Georgia (Savannah); and Florida (Jacksonville, Coconut Grove, and Royal Palm Hammock). **South** to southern Florida (Royal Palm Hammock); the Gulf coast of Florida (Ozona, Wakulla Beach, and Pensacola); Mississippi (Biloxi); Louisiana (New Orleans); Texas (Rockport, Corpus Christi, and Brownsville); Tamaulipas (Altamira); Veracruz (Orizaba); and Guatemala (Chimuy and Tecpán). **West** to western Guatemala (Tecpán and Nenton); Guerrero (Chilpancingo and Coyuca); Colima (Manzillo); Jalisco (Mazatlán); Baja California (Cape San Lucas and Santa Margarita Island); the Pacific coast of California (San Clemente and Santa Cruz Islands, Santa Barbara, San Francisco, and Eureka); western Oregon (Eugene); and northwestern Washington (Tacoma and Seattle).

The above ranges apply to the species as a whole, of which four subspecies or geographic races are recognized: the eastern orange-crowned warbler (*V. c. celata*) breeds from northern Alaska, northern Mackenzie and northern Manitoba south to central Alaska, northern Alberta, and Saskatchewan to southern Manitoba; the Rocky Mountain orange-crowned warbler (*V. c. orestera*) breeds from northern British Columbia, central Alberta, and southwestern Saskatchewan southward east of the Cascades and Sierra Nevadas; the lutescent orange-crowned warbler (*V. c. lutescens*) breeds in the Pacific coast region from Cook Inlet, Alaska, south to southern California and eastward in California to the west slope of the Sierra Nevadas; the dusky orange-crowned warbler (*V. c. sordida*) is resident on the southern coastal islands of California and locally on the adjacent mainland.

Migration.—The orange-crowned warbler is of rare occurrence in the northeastern United States where it is reported more often in fall than in spring.

Early dates of spring arrival are: Pennsylvania—Harrisburg, April 21. New York—Rochester, April 27. Tennessee—Memphis, April 5. Kentucky—Bowling Green, April 23. Ohio—Oberlin, April 14. Michigan—Ann Arbor, April 26. Ontario—Queensborough, April 26. Missouri—Columbia, April 20. Iowa—Sioux City, April 24. Wisconsin—Madison, April 19. Minnesota—Red Wing, April 19. Kansas—Lake Quivira, April 18. Nebraska—Fairbury, April 16. South Dakota—Arlington, April 22. North Dakota—Fargo, April 22. Manitoba—Winnipeg, April 25. Saskatchewan—East End, May 2. Mackenzie—Simpson, May 21. New Mexico—Carlisle, April 28. Colorado—Colorado Springs, April 27. Wyoming—Laramie, April 21. Montana—Fortine, April 28. Alberta—Glenevis, April 28. Oregon—Portland, March 26. Washington—Bellingham, March 2. British Columbia—Courtney, March 24. Yukon—Carcross, April 26. Alaska—Ketchikan, April 26; Tanana Crossing, May 18.

Late dates of spring departure of migrants are: Florida—Pensacola, April 20. Georgia—Atlanta, April 29. South Carolina—Aiken, May 3. North Carolina—Hendersonville, May 9. West Virginia—Wheeling, May 12. New York—Canandaigua, May 27. Louisiana—New Orleans, April 3. Mississippi—Biloxi, April 21. Tennessee—Knoxville, April 25. Ohio—Austinburg, May 30. Ontario—Ottawa, May 28. Missouri—St. Louis, May 8. Iowa—Des Moines, June 6. Wisconsin—Racine, May 24. Michigan—Sault Ste. Marie, June 3. Minnesota—Rochester, May 28. Texas—Lytle, May 19. Oklahoma—Copan, May 2. Kansas—Onaga, May 22. Nebraska—Neligh, May

13. South Dakota—Faulkton, June 1. North Dakota—Fargo, June 6.

Late dates of fall departure are: Alaska—Craig, September 24. British Columbia—Atlin, September 9; Okanagan Landing, October 23. Washington—Semiahmoo, October 8. Oregon—Prospect, October 8. Alberta—Glenevis, October 5. Montana—Fort Keogh, September 22. Wyoming—Laramie, October 25. Utah—St. George, October 12. New Mexico—Gallinas Mountains, October 9. Saskatchewan—East End, September 16. Manitoba—Aweme, October 14. North Dakota—Fargo, October 19. South Dakota—Aberdeen, October 14. Nebraska—Hastings, October 8. Kansas—Wichita, November 2. Oklahoma—Norman, October 19. Minnesota—Minneapolis, October 20. Wisconsin—Milwaukee, October 26. Iowa—Giard, October 19. Ontario—Kingston, October 6. Michigan—Ann Arbor, November 1. Ohio—Toledo, October 27. Illinois—La Grange, October 28. Tennessee—Dover, October 26. Massachusetts—Lynn, November 30. New York—Rochester, October 9. Pennsylvania—Harrisburg, November 19 (bird was banded).

Early dates of fall arrival are: North Dakota—Ryder, August 18. South Dakota—Faulkton, August 23. Nebraska—Hastings, September 16. Texas—Lytle, August 29. Minnesota—Lanesboro, August 3. Wisconsin—New London, August 24. Iowa—National, August 28. Michigan—Blaney, August 19. Illinois—Chicago, August 28. Ontario—Ottawa, September 7. Ohio—Columbus, September 9. Tennessee—Clarksville, October 16. Arkansas—Hot Springs, September 11. Louisiana—New Iberia, November 19. Mississippi—Saucier, October 12. Massachusetts—Concord, October 2. Pennsylvania—Erie, September 15. West Virginia—Bethany, October 20. Georgia—Athens, October 12. South Carolina—Frogmore, September 20. Florida—Key West, October 5.

Banding.—Two returns of banded orange-crowned warblers seem worth recording. One banded at Mellette, S. Dak., on September 21, 1939, was found, probably dead, on December 13, 1940 at Webster, Wis. Another banded at Eagle Rock, Calif., on April 3, 1940, was found dead, on June 21, 1940 at Wards Cove, Alaska.

Casual record.—An immature orange-crowned warbler was collected October 14, 1906, at Lichtenfels, Greenland.

Egg dates.—Alaska: 10 records, June 8 to July 2.

California: 71 records, April 3 to June 24; 36 records, April 20 to May 12, indicating the height of the season.

Washington: 17 records, April 25 to June 25; 9 records, May 13 to 24.

VERMIVORA CELATA ORESTERA Oberholser

ROCKY MOUNTAIN ORANGE-CROWNED WARBLER

HABITS

Although recognized and described by Dr. Harry C. Oberholser (1905) over 45 years ago, this well-marked subspecies was not accepted by the Committee for addition to the A. O. U. Check-List until comparatively recently.

It is described as "similar to *Vermivora celata celata*, but larger and much more yellowish, both above and below." Dr. Oberholser (1905) adds the following remarks: "This new form has usually been included with *V. celata celata*, but breeding specimens recently obtained, principally from New Mexico and British Columbia, indicate its much closer relationship, in all respects except size, with the west coast forms. From *Vermivora celata lutescens* it may, however, readily be distinguished by its duller, less yellowish color, both above and below, and by its much greater size."

He gives its geographical range as: "Mountains of New Mexico, Arizona, and southeastern California to British Columbia; in migration to Minnesota and Pennsylvania, south to Texas, and Mexico to Lower California, Michoacan, Guerrero, and Puebla."

Nesting.—Stanley G. Jewett (1934) reports a nest within the range of this race, of which he writes:

> On June 18, 1934, a nest of this species was found at 6,000 feet altitude on Hart Mountain, Lake County, Oregon. The location was a rather dense mixed grove of aspen, alder, willow, and yellow pine. The female was on the nest, which was placed on the ground well under a small leaning willow stump, about five inches in diameter, that had been cut off about a foot above the ground, leaving the stump leaning at an angle of about 45 degrees. Weeds had grown over the stump forming a loose canopy of vegetation which protected the nest and sitting bird from being easily seen. The nest was composed of coarse dry strips of willow bark, lined with porcupine hairs. It measured, inside, 50 mm. in width and 33 mm. in depth.

A nest and four eggs of this species, probably *orestera*, is in the Thayer collection in Cambridge; it was collected at Banff, Alberta, on June 9, 1902. The nest was said to be "in root of a shrub, a few inches above the ground". It is compactly made of the finest larch twigs, yellow birch bark, fine shreds of coarse weed stems, other fine plant fibers and fine grasses, fine strips of inner bark, and a little plant down; it is lined with finer pieces of the same materials and some black and white hairs. The outside diameter is about 3 inches, and the height about 2 inches; inside, it measures about 1¾ inches in diameter and 1¼ inches in depth. A set of three eggs in my collection was taken May 14, 1909, near Glacier National Park, Mont.; the nest was on the ground, concealed by grass on a hillside. The measurements of the eggs of this race, which are indistinguishable from those of other races of the species, are included in those of the type race.

VERMIVORA CELATA LUTESCENS (Ridgway)

LUTESCENT ORANGE-CROWNED WARBLER

HABITS

This brightly colored race of the orange-crowned warbler group is widely distributed during the breeding season along the Pacific coast regions from southern Alaska to southern California and migrates in the fall southward to Baja California, western Mexico, and Guatemala. It differs from typical *celata* in being more brightly olive-green above and distinctly yellow below; in strong light it seems to be a yellow rather than an olive bird.

Dr. Walter K. Fisher sent the following sketch of it in its California haunts to Dr. Chapman (1907):

> Chaparral hillsides and brushy open woods are the favorite haunts of the Lutescent Warbler. Its nest is built on or near the ground, usually in a bramble tangle or under a rooty bank, and the bird itself hunts near the ground, flitting here and there through the miniature jungle of wild lilacs, baccharis and hazel bushes. Its dull greenish color harmonizes with the dusty summer foliage of our California chaparral, and with the fallen leaves and tangle of stems that constitute its normal background. It impresses one chiefly by its lack of any distinctive markings, and the young of the year, particularly, approach that tint which has been facetiously called "museum color."

Ordinarily the crown-patch is invisible as the little fellow fidgets among the undergrowth, but at a distance of 3 feet Mr. W. L. Finley was able to distinguish it when the bird ruffled its feathers in alarm.

In May, 1911, while I was waiting in Seattle, Wash., to take ship to the Aleutian Islands with R. H. Beck and Dr. Alexander Wetmore, we were shown by Samuel F. Rathbun the haunts of the lutescent orange-crowned warbler around Seattle. He says that it is one of the more common warblers of the region and is widely distributed. It favors small deciduous growths in more or less open situations, with or without accompanying evergreens. "It is also partial to the edges of old clearings fringed with a deciduous growth." He says that it is an early migrant, arriving early in April or sometimes in the latter part of March, and departing in September.

On Mount Rainier, according to Taylor and Shaw (1927), it was—

> fairly common in the Hudsonian Zone (4,500 feet to 6,500 feet); occurs also, but more rarely, in the Canadian Zone between 3,500 and 4,500 feet. * * * The lutescent warbler was commonly found in the mountain ash, huckleberry, azalea, and willow brush, principally in the open meadow country of the subalpine parks. Warm and sunny south-facing slopes were favorite places of resort, especially

after a period of cold or fog. Occasionally the bird was found in patches of Sitka valerian; at other times in the lower branches of alpine firs. His summer foraging seems for the most part to be done within 10 feet of the ground, though in the fall, when migrating, he apparently takes to the tree tops.

Nesting.—On May 7, 1911, Samuel F. Rathbun took us over to Mercer Island in Lake Washington. At that time, this interesting island was heavily forested in some places with a virgin growth of tall firs, in which we saw the sooty grouse and heard it hooting, later finding its nest in an open clearing. While walking through another open space among some scattered groups of small fir trees, Mr. Beck flushed a lutescent warbler from her nest in a hummock covered with the tangled fronds of dead brakes (*Pteridium aquilinum*). The nest was so well concealed in the mass of dead ferns that we had difficulty in finding it. It was made of dead grasses and leaves, deeply imbedded in the moss of the hummock, and was lined with finer grasses and hairs. It held four fresh eggs. Three days later, Dr. Wetmore took a set of five fresh eggs at Redmond. This nest was located beside a woodland path at the edge of a swamp; it was well hidden on the ground, under a stick that was leaning against a log. It was made of similar materials and was lined with white horsehair.

Mr. Rathbun mentions three nests (MS.), found in that same vicinity; one was well hidden under some fallen dead brakes; and the other two were beautifully concealed in the centers of small huckleberry bushes.

William L. Finley (1904b) records six Oregon nests. The first "was tucked up under some dry ferns in the bank of a little hollow where a tree had been uprooted. * * * The second nest was on a hillside under a fir tree, placed on the ground in a tangle of grass and briar." Another was "in a sloping bank just beside a woodland path. A fourth nest was tucked under the overhanging grasses and leaves in an old railroad cut." He found two nests in bushes above ground. He saw a female carrying "food into the thick foliage of an arrowwood bush. A cluster of twigs often sprouts out near the upper end of the branch and here, in the fall, the leaves collect in a thick bunch. In one of these bunches, 3 feet from the ground, the warbler had tunneled out the dry leaves and snugly fitted in her nest making a dark and well-protected home." He found another nest 2 feet up in a bush, within a few yards of the ocean beach.

Henry W. Carriger, of Sonoma, Calif., (1899) mentions two more elevated nests of the lutescent warbler. He writes:

> On May 31, 1897, I found a nest of the Lutescent Warbler placed three feet from the ground in a bunch of vines. * * * On May 3, 1899, * * * I flushed a bird from a nest in an oak tree, and was surprised to see it was a Lutescent Warbler. The nest was six feet from the ground and three feet from

the trunk of the tree. A horizontal limb branched out from the tree and a small branch stuck up from it for about eight inches, and over this was a great quantity of Spanish moss (*Ramalina retiformis*), which fell over the horizontal limb. The nest is quite bulky, composed of leaves, grass and bark strips, lined with hair and fine grass, and was partially supported by both limbs and the moss, which is all about it and which forms quite a cover for the eggs.

Eggs.—The lutescent warbler lays from 3 to 6 eggs to a set, probably most often 4. These are ovate or short ovate and are practically lusterless. The white or creamy white ground color is speckled, spotted or occasionally blotched with shades of reddish brown, such as "russet," "Mars brown," "chestnut," and "auburn," intermingled with underlying shades of "light brownish drab." The markings are usually concentrated at the large end, but some eggs are speckled more or less evenly over the entire surface. Small scrawls of blackish brown may be found on some of the more heavily marked types. The measurements of 50 eggs average 16.2 by 12.6 millimeters: the eggs showing the four extremes measure **17.7** by 12.8, 16.8 by **13.5**, **14.7** by 12.2, and 15.9 by **11.1** millimeters (Harris).

Young.—We seem to have no information on incubation or on the care and development of the young.

Plumages.—The molts and plumages are evidently similar to those of the orange-crowned warbler, though the lutescent is, of course, decidedly more yellow in all plumages.

Food.—Prof. Beal (1907) examined the contents of the stomachs of 65 California specimens of this species.

> Less than 9 percent of the food is vegetable matter, and is made up of 3 percent of fruit and rather more than 5 percent of various substances, such as leaf galls, seeds, and rubbish. Fruit was found in only a few stomachs, but the percentage in each was considerable; figs were the only variety identified. [Of the 91 percent animal matter,] Hemiptera are the largest item and amount to over 25 percent, mostly leaf-bugs, leaf-hoppers, plant-lice, and scales. Plant-lice were found in only one stomach and scales in 5, of which 3 contained the black olive species. Beetles amount to about 19 percent of the food, and with the exception of a few Coccinellidae are of harmful families, among which are a number of weevils. * * * Caterpillars are eaten rather irregularly, though they aggregate 24 percent for the year. Stomachs collected in several months contained none, while in others they amounted to more than half of the food. * * * Hymenoptera amount nearly to 15 percent, and are mostly small wasps, though some ants are eaten.

Other items were flies, less than 1 percent, and spiders, 7 percent. W. L. McAtee (1912) says that this is one of only two wood warblers known to prey upon codling moths. "The lutescent warbler shows a strong liking for the pupae, two taken in California in May having eaten 10 and 18 pupae, respectively."

Behavior.—Mrs. Wheelock (1904) writes thus of its feeding activities: "All day long he flits about through the oak trees, leaning away over the tips of the boughs to investigate a spray of leaves, or stretching up his pretty head to reach a blossom just above him; now clinging head downward underneath a spray, or hovering under the yellow tassels as a bee hovers beneath a flower."

Voice.—Samuel F. Rathbun (MS.) gives me his impression of the song of the lutescent warbler as follows: "Its song is a succession of trilling notes on a slightly rising then falling key, the latter more lightly given and faster. There is an apparent ease in this song that is suggestive of airiness, and, although simple in construction, it is pleasing to hear and further bears the stamp of distinctiveness."

Fall.—The fall migration is southward to southern California, western Mexico, and Guatemala. The movement is apparently leisurely and quite prolonged, for the earliest birds begin leaving western Washington in August and September, and Theed Pearse gives me two October dates for Vancouver Island, with his latest date November 1. Taylor and Shaw (1927) write of the fall movement on Mount Rainier as follows:

> The post-nuptial scatter movement was in full swing by the middle of August. At this time the lutescent warbler was often found in the same flocks with Shufeldt juncos, western golden-crowned kinglets, or chestnut-backed chickadees. It is not unlikely that there is some good reason for this flocking, aside from the companionship involved. The warblers and the juncos, kinglets, or chickadees probably do not compete for food as would one warbler with another of the same species. The individual warbler, attached to a flock of kinglets, let us say, may be the more surely guided to available food. Then, too, differences in alertness of the two or more species concerned may afford greater protection to each than would be the case if they remained separate.

Robert Ridgway (1877) met with these warblers in large numbers in Nevada:

> In the fall, the thickets and lower shrubbery along the streams, particularly those of the lower cañons, would fairly swarm with them during the early portion of the mornings, as they busily sought their food, in company with various insectivorous birds, especially the Black-capped Green Warbler (*Myiodioctes pusillus*) and Swainson's Vireo (*Vireosylvia swainsoni*). At such times they uttered frequently their sharp note of chip. The brightly-colored specimens representing *H. lutescens* were prevalent in the western depression of the Basin, but were not observed eastward of the upper portion of the Valley of the Humboldt, nor at any locality during the summer; and wherever found, were associated with individuals of the other form, which is the only one found breeding on the mountains. It is therefore inferred that all these individuals were migrants from the northern Pacific Coast region and the Sierra Nevada, while those of *H. celata* proper were from the higher portions of the more eastern mountains, or from farther northward in the Rocky Mountain ranges, full-fledged young birds being numerous in the high aspen woods of the Wahsatch Mountains in July and August.

VERMIVORA CELATA SORDIDA (Townsend)

DUSKY ORANGE-CROWNED WARBLER

PLATE 15

HABITS

The subspecific characters of this warbler, as given by the original describer, C. H. Townsend (1890), are: "Adult male: Entire plumage decidedly darker than *H. celata lutescens.* Feet and bill larger; wings slightly shorter. There is an appearance of grayness about the upper plumage, owing to a leaden tinge on ends of feathers. Throat and under parts slightly streaked."

The principal breeding range of the dusky warbler is on the Santa Barbara Islands off the coast of southern California, but it has also been known to breed in San Diego and probably breeds farther south in Baja California, and on the Todos Santos Islands, off that coast.

The dusky orange-crowned warbler was discovered by Dr. Townsend on San Clemente Island January 25, 1889, but it does not seem to be so common there as on some of the other islands. According to A. Brazier Howell (1917) it has been reported from all of the channel islands except San Nicholas, which is too barren for it; and its occurrence on Santa Barbara Island is doubtful, as this precipitous island is not suited for it. It is probably commonest on Santa Catalina Island, "in the darker canyons and on the wooded hillsides."

J. Stuart Rowley writes to me: "I found that the weekend nearest the 15th of April was the ideal time to hunt nests of this warblers on Catalina Island, and after much hiking about this island I finally located a little ravine, only about a mile or so out of the own of Avalon, where these warblers nested abundantly, due to the little trickle of surface water in the bottom of the ravine. Since most of the ravines here are dry, this one was 'made to order' and I enjoyed the chance to find many nests in the short time allotted to me. Around the middle of April this little ravine fairly trilled with the songs of many males, who were constantly pursuing trespassing individuals out of their nesting territories, only to return and continue their melodic songs."

Nesting.—Of its nesting habits, J. Stuart Rowley continues: "I have found dusky warblers nesting in every conceivable sort of place, ranging from those placed on the ground in the grass to those placed 15 feet up in toyon trees. The usual nesting site here seems to be in a small toyon bush, rather well concealed, but not over 2 to 3 feet from the ground; the nests are made of fibres and grasses and, although nicely cupped and lined, are rather bulky affairs externally for a warbler to build." Howell (1917) writes:

> The usual nesting site of the Lutescent Warbler is on the ground, but I have never heard of *sordida* building in such a situation. On the smaller barren islands, such as the Coronados and Todos Santos (where it is common), they build in a bush or tangle of vines, a foot or so above the ground, and the nest is always mainly constructed of gray moss, where this is to be had, lined with a little fine grass. On the larger islands, where there are good-sized trees, the site chosen may be a thicket of vines several feet above the bed of a stream, a small shrub, say four feet up, or perhaps an oak as much as fifteen feet above the ground. In such case the nest is quite substantially made of leaves, twigs, bark, rootlets, and often a little sheep wool. Three or four eggs constitute a set, and at least two broods of young are raised each year.

A most unusual nesting site for a dusky warbler is described by Clinton G. Abbott (1926). It was—

> a decorative fern basket inside a small lath house adjoining the home of Mrs. A. P. Johnson, Jr., at 2470 C Street, San Diego. * * * Her house is in one of the older residential sections of the city, known as Golden Hill. The homes here are large and surrounded by more or less extensive grounds, but the whole aspect is distinctly urban, with streets everywhere paved. Broadway, with double trolley tracks, is only one block away. The lath house, sixteen by twenty-four feet in size, was filled with a luxuriant growth of cultivated plants. A rectangular path within was marked at its corners by four wire fern baskets suspended about four feet from the ground. In one of these were the remains of the two previous years' nests, and in the basket diagonally opposite was the inhabited nest, which contained three eggs. Although the eggs were manifestly not fresh, there was no bird about and they seemed cool to my touch. I waited about for fully ten minutes and was beginning to fear that disaster had overtaken the home, when I heard a low, scolding note overhead. Then down from between the slats hopped the dainty little warbler, and, with no concern whatsoever, she took her place upon the eggs, although I was standing in full view close by. [The nest was] cosily placed in the moss at the base of the ferns.
>
> We soon discovered that not only was the bird practically fearless in the ordinary sense, but that she would even allow us to touch her without leaving her nest. She would permit us to raise her from her eggs with no greater protest than a pecking at the intruding finger. If she was not sitting sufficiently broadside for a good photograph, it was possible to arrange her the way we wanted her! Sometimes, if our familiarity was beyond her patience, she would merely hop among the foliage behind the nest, wait there for a few minutes, and then nestle back on her eggs.

Eggs.—Three eggs seem to constitute the average set for the dusky warbler, with occasionally only two or as many as four. Mr. Rowley tells me that, out of at least two dozen nests examined, he found only two sets of four; one nest had only one newly hatched young, and two or three nests held two well-incubated eggs. The eggs are apparently indistinguishable from those of the mainland races. The measurements of 27 eggs average 17.0 by 13.2 millimeters; the eggs showing the four extremes measure **18.5** by 13.5, 17.6 by **14.0**, and **16.0** by **12.7** millimeters.

Winter.—Many of the dusky warblers, perhaps most of them, desert the islands in the fall when they become dry and uninviting, for the winter spreading widely on the mainland as far north as the San Francisco Bay region and inland to Merced County. Dr. Joseph Grinnell (1898) says: "This subspecies appears in the vicinity of Pasadena in the oak regions and along the arroyos in large numbers during August, and even by the middle of July. Remains in diminishing numbers through the winter; the latest specimen noted in the spring was secured by me, Feb. 29 ('96)."

VERMIVORA RUFICAPILLA RUFICAPILLA (Wilson)

EASTERN NASHVILLE WARBLER

PLATES 16, 17

HABITS

Alexander Wilson discovered this species near Nashville, Tenn., and gave it the name Nashville warbler. Baird, Brewer, and Ridgway (1874) say of its early history: "For a long while our older naturalists regarded it as a very rare species, and knew nothing as to its habits or distribution. Wilson, who first met with it in 1811, never found more than three specimens, which he procured near Nashville, Tenn. Audubon only met with three or four, and these he obtained in Louisiana and Kentucky. These and a few others in Titian Peale's collection, supposed to have been obtained in Pennsylvania, were all he ever saw. Mr. Nuttall at first regarded it as very rare, and as a Southern species."

This is not strange when we stop to consider that this bird is more or less irregular in its occurrence, apparently fluctuating in numbers in different localities and perhaps choosing different routes of migration. Its record here in eastern Massachusetts illustrates this point. Thomas Nuttall never saw the bird while he lived in Cambridge, from 1825 to 1834. Dr. Samuel Cabot, who lived there from 1832 to 1836, told William Brewster (1906) that he was sure that it did not occur regularly in eastern Massachusetts at that time. According to Brewster:

> Soon afterwards a few birds began to appear every season. They increased in numbers, gradually but steadily, until they had become so common that in 1842 he obtained ten specimens in the course of a single morning.
>
> In 1868, and for some fifteen years later, I found Nashville Warblers breeding rather numerously in Waltham, Lexington, Arlington and Belmont, usually in dry and somewhat barren tracts sparsely covered with gray birches, oaks or red cedars, or with scattered pitch pines. A few birds continue to occupy certain of these stations, but in all of the towns just mentioned the Nashville Warbler is less common and decidedly less generally distributed in summer now than it was twenty-five or thirty years ago.

Forbush (1929) found it "more common in eastern Massachusetts in the latter quarter of the last century than it is today." And my own experience has been similar; prior to 1900 we used to consider the Nashville Warbler a common bird on migrations and even found it breeding in Bristol County in 1892; but we have seen very little of it since the turn of the century.

Spring.—From its winter home in Mexico and Central America, the eastern Nashville warbler seems to migrate mainly northeastward through Texas to the lower Mississippi Valley and then west of the Alleghenies to New England and northward up the central valleys. Some individuals apparently fly straight across the Gulf of Mexico, but it is very rare in Louisiana, for which Dr. Oberholser (1938) gives only three records. It seems to be very rare, or entirely unknown, in any of the southeastern States, east of Louisiana and south of Virginia, except in some of the mountains.

According to Dr. Chapman's (1907) tables, about 18 days elapse between the average date of the first arrival of the species in Missouri and that of its first appearance in Minnesota, and it seems to require exactly the same time to migrate from West Virginia to New Brunswick.

Dr. Dayton Stoner (1932) says of its migration through the Oneida Lake region, N. Y.:

> The Nashville warbler here seems to prefer coppices along the edges of woodland such as young aspen and maple and elm thickets and other small growth that springs up in cut-over and burned-over areas. In such situations I have found it singing persistently in late May and the first few days in June. This warbler and the chestnut-sided are often found together. However, it does not confine its activities to thickets, for it not infrequently visits woodlands of tall elm, maple, beech and other deciduous trees, as well as mixed forest and the vegetation in door-yards. The flowering currant is in full bloom at the time this bird reaches the height of its abundance and I have seen it visiting such shrubbery during the first part of May.

In Massachusetts in May, according to Forbush (1929), "among its favorite haunts are the bushy edges of woodlands, whether along roads, railroads or streams, or about ponds, lakes, marshes, swamps or open fields. It may often be found among willows, alders, birches or poplars. Old neglected fields and pastures, with scattered growths of birches and bushes, are favorite feeding grounds, but the bird also visits orchards, gardens and shade trees, even in city parks. It may be found on dry lands where scattered pitch pines grow, and on moist lands with rank shrubbery."

W. E. Clyde Todd (1940) says of the migration in western Pennsylvania: "The Nashville Warbler appears during the flood tide of the warbler migration in both spring and fall and is sometimes inordinately abundant. * * *

Almost every spring there is a day or two of decided movement, when the species is very common and on occasion exceedingly abundant. On May 3, 1901, I witnessed a remarkable flight at Beaver. That morning the woods everywhere were full of Nashville warblers, to the exclusion of almost all other kinds. I counted a dozen in one tree. They kept mostly in the treetops and were singing very little."

These warblers are also sometimes abundant in Ohio, for Milton B. Trautman (1940) noted as many as 80 individuals on May 15, 1932, at Buckeye Lake.

Nesting.—The nesting haunts of the eastern Nashville warbler are quite varied, and habitats similar to some of those frequented on the spring migration seem to be suitable for breeding grounds. But the nest is always placed on the ground and generally is well hidden. Gerald Thayer wrote to Dr. Chapman (1907):

> Birch Warbler would be a good name for this bird as it appears in the Monadnock region where it breeds abundantly. For here it is nowhere so common as in abandoned fields and mountain pastures half smothered by small gray birches. From the airy upper story of these low and often dense birch copses the Nashvilles sing; and among the club-mosses and ferns, and the hardhacks and other scrubby brushes at their bases and around their borders, the Nashvilles build their nests. But such is merely their most characteristic home. * * * Dark spruce woods they do not favor, nor big, mixed virgin timber; but even in these places, one is likely to find them wherever there is a little "oasis" of sunlight and smaller deciduous growth. They are fairly common among the scanty spruces, mountain ashes, and white birches of the rocky ridge of Mt. Monadnock, almost to the top—3,169 feet.

F. H. Kennard records in his notes two nests found near Lancaster, N. H. One was among some dead weeds on a mossy hummock in a pasture; the other was in a swamp, at the base of and under a clump of alders beside a path. Miss Cordelia J. Stanwood (1910), of Ellsworth, Maine, writes:

> When a growth of evergreens—pine, fir, spruce and hemlock—is cut, it is succeeded by a growth of hard wood—gray, white and yellow birches, maple, poplar, beech, cherry and larch—and vice versa. As the woodland is cut in strips, there are always these growths in juxtaposition. Though the nest of the Nashville is always placed among the gray birches, the inevitable strip of evergreen woodland is near at hand, and a swale not far away.
>
> The nest of the Nashville is sometimes placed in comparatively low ground (that is, compared with its immediate surroundings), in soft green moss under an apology for a shrub, again in the side of a knoll covered with bird wheat (hair-cap) moss, or at other times in an open space in the woodlands under a stump, or tent-like mass of grass, or a clump of gray birch saplings. Around the top is usually woven a rim of coarse, soft, green moss; sometimes dried boulder fern or bracken is added. The side coming against the stump or overhanging moss lacks this foundation. The nest is lined with fine hay, if it abounds in the neighborhood, or pine needles if they are nearer at hand. Sometimes both are used. The red fruit stems of bird wheat moss and rabbit's hair are often employed. One or two birds have preferred some black, hair-like vegetable fibre for lining matter, one bird, horse hair.

Ora W. Knight (1908) mentions a Maine nest that "was situated on the ground on an open wooded hillside at the foot of and between two small spruce trees, and was well imbedded in the moss. It measures in depth outside one and three-fourths inches, and inside one inch, the diameter outside was three and a quarter. * * * Nest building begins soon after the birds have arrived, and presumably the female does most of the work, while the male perches in a near by sapling and sings. * * * It takes from seven to nine days to build the nest, and on its completion an egg is laid each day until the set is completed. The eggs are usually laid between six and ten in the morning."

A nest found by Henry Mousley (1918) near Hatley, Quebec, "was located at the foot of a spirea bush on a little mound, well sunk into the surrounding hair-cap moss (*Polytrichum commune*) and dwarf cornel or bunchberry (*Cornus canadensis*) of which the mound was carpeted. It was entirely hidden from sight and would never have been found had I not flushed the female from her set of five eggs."

The only local nest of which we have any record was found by Owen Durfee (MS.) in Rehoboth, Mass., on June 2, 1892. It was only partially concealed among some very low bushes, grass, and other herbage near the foot of a small hill in neglected pasture land; the hill had a scattered growth of oak and beech saplings and had been tramped over by cattle.

Frank A. Pitelka (1940a) found the Nashville warbler breeding in northeastern Illinois in "oak-maple-hickory climax woodland with semi-dense undergrowth, * * * with the stream cutting it and a semi-swampy, sedge-grass area with willow thickets and scattered elms and ashes." In northern Michigan, he found it "in spruce and cedar bogs and in sandy woods of aspen, birch, and Norway pine."

Richard C. Harlow tells me that most of the nests he has found in New Brunswick, about 10, are very frail, but are lined with moose hair. He has found 7 nests in the mountains of Pennsylvania, where the normal lining is deer hair.

Eggs.—The first set of eggs for the Nashville warbler seems to be always either 4 or 5; reported sets of 3 are probably incomplete or late sets. The eggs are ovate or short ovate and are only slightly lustrous. They are white or creamy white, speckled with shades of reddish brown, such as "chestnut" and "auburn," mixed with "light brownish drab." On some eggs the markings are fairly evenly scattered over the entire surface, but usually they are concentrated and form a wreath at the large end. Occasionally eggs are more boldly marked with spots and small blotches or short scrawls; others are nearly immaculate. The measurements of 50 eggs average 15.7 by 12.1 millimeters; the eggs showing the four extremes measure **17.2** by 12.7, 16.4 by **13.0**, **14.5** by 11.6, and 15.2 by **11.5** millimeters (Harris).

Young.—The period of incubation is said to be from 11 to 12 days, and probably the female does most of it, though Mr. Knight (1908) says: "One bird relieves the other on the nest and at times when the eggs are very near the hatching point I have seen the male bring insects to its mate on the nest. Possibly he may feed the female at earlier stages of incubation but I have not seen him do so. Both birds feed the young, giving them at first soft grubs and caterpillars, later on small beetles, flies and similar insects. * * * The young leave about the eleventh day after hatching."

For a further study of the nesting behavior of the Nashville warbler, the reader is referred, to an excellent paper on the subject by Louise de Kiriline Lawrence (1948).

Plumages.—Dr. Dwight (1900) calls the natal down "sepia-brown," and describes the juvenal plumage of the Nashville warbler as follows: "Pileum hair-brown, back darker, olive tinged, and rump olive-green. Below, pale yellowish wood-brown, straw-yellow on abdomen and crissum. Wings and tail olive-brown broadly edged with bright olive-green, the median and greater coverts tipped with pale buff-yellow forming two wing bands. Lores and auriculars mouse-gray, the orbital ring pale buff."

The sexes are alike in juvenal plumage. A postjuvenal molt occurs in July and August that involves the contour plumage and the wing coverts but not the rest of the wings or the tail. This produces a first winter plumage in which young birds become practically indistinguishable from adults in many cases, but the chestnut crown patch is generally smaller and more veiled in the younger male and is often lacking in the young female.

Dr. Dwight (1900) says that the first nuptial plumage is "acquired by a partial prenuptial moult which involves chiefly the crown, sides of head and throat, but not the rest of the body plumage nor the wings and tail. The head becomes plumbeous gray, the edgings only half concealing the rich chestnut of the crown. The orbital ring is white and conspicuous. Wear is marked, bringing the gray of the nape into contrast with the greenish back, later exposing the chestnut of the crown."

A complete postnuptial molt in July and August produces the fully adult plumage. In fresh fall plumage the head is browner than in spring, the back is grayer, the crown patch is more veiled with gray tips, and the breast is tinged with brownish. The females are paler than the males, with less chestnut in the crown. Adults probably have a partial prenuptial molt similar to that of young birds.

Food.—Very little has been published on the food of the Nashville warbler. Knight (1908) says that "the food of the adults consists of beetles, larvae of various insects and the eggs of various insects. In fact they eat almost anything which they can glean in the insect line from the shrubbery and ground."

Forbush (1929) says: "As the bird ranges from the ground to the tree-tops it takes most of the insects that any warbler will eat, among them flies, young grasshoppers and locusts, leaf-hoppers and many plant-lice, caterpillars both hairless and hairy, among them the gipsy, brown-tail and tent caterpillar, most of which are taken when young and small; also small wood-boring beetles are eaten, and other small insects of many species. The bird appears to be almost wholly insectivorous."

Behavior.—The eastern Nashville warbler is an active, sprightly, restless member of an active family, ranging in its foraging mainly in the lower story of the open woodlands and more often in the low trees and shrubbery around the borders of the forest. When thus engaged it is not particularly shy and often seems quite unconscious of the presence of an observer. On migrations it seems to be sociably inclined and may be seen associated with the mixed flocks of warblers that are drifting through the tree tops. At these seasons it often visits our orchards and the shrubbery in our gardens, giving us a glimpse of green and gold among the blossoms and opening leaves.

J. W. Preston (1891) describes an interesting manner of foraging: "One will fly to the foot of a fir tree or other conifer and begin an upward search, hopping energetically from branch to branch until the very highest point is reached, when the bird drops lightly down to the foot of another tree, much as does the Brown Creeper. When an insect is discovered the bird secures it by a sudden bound, and, should the object be not easily dislodged, *Helminthophila* sustains himself on flapping wings until his purpose is accomplished, which often requires several moments."

Voice.—Gerald Thayer gave Dr. Chapman (1907) a very good description of the songs and calls as follows:

> The Nashville has at least two main perch-songs, and a flight-song, all subject to a good deal of variation. It belongs decidedly among the full-voiced Warblers. * * * Its commoner perch-song consists of a string of six or eight or more, lively, rapid notes, suddenly congested into a pleasant, rolling twitter, lower in key than the first part of the song, and about half as long. In the other perch-song, the notes of what correspond to the rolling twitter are separate and richer, and the second part of the song is longer and more noticeable than the first, whose notes are few and slurred, while the whole is more languidly delivered.
>
> The differences are hard to describe intelligibly; but in reality they are pronounced and constant. The flight-song, a fairly common performance in late summer, is sung from the height of five to forty feet above the (usually low) tree-tops. It is like the commoner perch-songs, but more hurried, and slightly elaborated, often with a few *chippings* added, at both ends. Among the Nash-

ville's calls a very small, dry *chip*, and a more metallic, louder *chip*, somewhat Water-Thrush-like, are noteworthy. It also *chippers* like a young Warbler or a Black-throated Green.

Miss Stanwood (1910a) writes:

> One common song sounds like *'tsin, 'tsin, 'tsee*, another *sweeten, sweeten, 'tsee*, a third, *sillup, sillup, sillup, 'tsce-e-e-e-e-e*. At other times the bird sings but part of the song as *sweeten, sweet;* or *sweeten, 'tsee;* or *sweeta, sweeta, 'tsee;* or recombines them differently as *sweeten, sweeten, sweeten, 'tsee-e-e-e-e-e*. * * * The song is loud, constant, and heard all over the locality, coming principally from the gray birches, but also from the maples, poplars, and evergreens. The bird sings from the tree-tops, but likewise from the middle branches, and I have seen it singing on the ground and just a few inches above it. My last record of its song in 1908 was made the 17th day of July, the first, May the 14th. Between these dates it sang well-nigh incessantly.

Knight (1908) says that, while the female is building the nest, "the male bird perches in a nearby sapling and sings leisurely '*pea-cie-pea-cie-hit-i-hit-i-hit*.'" Wilson (1832) thought that the "notes very much resembled the breaking of small dry twigs, or the striking of small pebbles of different sizes smartly against each other for six or seven times, and loud enough to be heard at the distance of thirty or forty yards." Rev. J. H. Langille (1884) writes: "The song of the Nashville Warbler is a composition, the first half of which is as nearly as possible like the thin but penetrating notes of the Black-and-white Creeping Warbler, while the last half is like the twitter of the Chipping Sparrow." He writes it in syllables as "*ke-tsee-ke-tsee-ke-tsee-chipe-ee-chip-ee-chip-ee-chip*."

The song has been said to resemble that of the chestnut-sided warbler, but the two are really quite distinct; the song of the latter does not end in a trill or in chipperings. It does, however, more closely resemble the song of the Tennessee warbler. Dr. Roberts (1936) heard the two singing at the same time and noted this difference: "The Nashville's song is an utterance of rather greater volume than that of the Tennessee and differs, also, in the fact that it has a short, rapidly weakening trill or slide, following a rather long and deliberate prelude of four or five notes; while the Tennessee has a brief prelude with a long finishing trill, increasing in loudness and intensity to an abrupt ending."

Aretas A. Saunders contributes the following study of the song: "The territory song of the Nashville warbler is in two parts, the first a series of 2-note phrases, and the second a series of rapid notes, commonly lower in pitch and just twice as fast as the notes of the first part; *pa tipa tipa tipa tipa titititititititit*. In 26 of my 29 records the second part of the song is lower than the first. In the other three it is higher. "The pitch of songs varies from G''' to F sharp'''', or five and a half tones. Single songs rarely vary more than one and a half or two tones. They are from 1⅗ to 2 seconds in length. The quality is rather musical, and some individuals have almost as sweet a tone as the yellow warbler. In my experience field students often confuse the songs of these two species.

"The nesting song may be heard commonly on the breeding grounds. I have several records from the Adirondacks. This song is in three or four parts, each part of three or four notes, and a little lower in pitch than the preceeding part. Two-note phrases are not commonly heard in the nesting song."

Francis H. Allen's rendering of the song is not very different from the first one of Mr. Saunders', though he noted some variation, and mentions in his notes an aberrant song, which "doubled the common song, which in this case had a first part consisting of only a single phrase, thus; *chip-ee*–(trill) *chip-ee*–(trill)."

Field marks.—The gray head, white eye ring, olive-green back, bright yellow under parts, and the absence of wing bars, with no white in the tail, are the distinguishing marks of the eastern Nashville warbler. The Connecticut warbler has a white eye ring but it has a gray throat, whereas the Nashville is bright yellow from chin to abdomen. The chestnut crown patch is not very conspicuous in the male and is less so, or entirely lacking, in the female; the female is duller yellow below and browner above than the male.

Enemies.—Like other ground-nesting birds, this warber has the usual four-footed enemies to contend with, but its nest is quite well hidden. Perhaps its worst bird enemy is the cowbird, although Friedmann (1934) listed it as an uncommon victim of this parasite and had only six records of it, the nests containing from one to two eggs of the cowbird.

Fall.—As soon as the molting season is over and the young birds are freshly clad in their winter dress the migration begins in Massachusetts. This takes place in August, and the last stragglers may be seen passing through in early October.

In Ohio, according to Mr. Trautman (1940), the first migrants are seen about the first of September, the peak of the migration coming during the latter half of that month when from 10 to 100 could be found in a day, and after the 10th of October only an occasional bird remains. He writes: "As with many other transient warblers the southward migration of the Nashville Warbler covered a greater period of time than did the spring movement, which usually lasted less than 30 days, whereas the fall movement generally extended more than 45 days. * * * In spring the species frequented the upper half of large trees and was more numerous in tall trees of woodlands than it was in smaller groups or rows of tall trees. In fall the species tended to inhabit the middle section of large trees, and it also resorted to the taller bushes and saplings, especially the larger hawthorn trees."

The fall migration route is apparently a reversal of the spring route southwestward into Mexico and Central America where it spends the winter.

Winter.—The Nashville warbler is evidently very common in winter in certain parts of Mexico, for Dr. C. William Beebe (1905) says: "At times there were twenty and thirty in sight at once near our camp in the Colima lowlands." These may have been the western race.

DISTRIBUTION

Range.—Southern Canada to Guatemala.

Breeding range.—The eastern Nashville and the western Nashville (formerly the Calaveras) warblers breed **north** to southern British Columbia (Tahsis Canal and Beaver Creek, Vancouver Island; Pemberton, Lillooet, and Revelstoke); northern Idaho (Clark Fork); northwestern Montana (Fortine); east-central Saskatchewan (Cumberland House); southern Manitoba (Duck Mountain, Lake St. Martin, and Hillside Beach); central Ontario (Casummit Lake, Lake Nipigon, and Lake Abitibi); and southern Quebec (Lake Baskatong, Quebec, Kamouraska, Mingan, and Natashquan River). **East** to southeastern Quebec (Natashquan River and the Magdalen Islands); and Nova Scotia (Baddeck, Halifax, and Barrington) **South** to Nova Scotia (Barrington); Maine (Ellsworth and Bath); northeastern Massachusetts (Haverhill and Beverly); southern Connecticut (Norwich); northern New Jersey (Moe and Beaufort Mountain); northeastern Pennsylvania (Dingman's Ferry, Mount Riga, and Highland Falls); northern West Virginia (Stony River Dam, Canaan Mountain, and Cranesville Swamp); northeastern Ohio (Pymatuming Lake); southern Michigan (Ann Arbor); northeastern Illinois (Deerfield); southern Wisconsin (Lake Koshkonong); central Minnesota (Onamia and Detroit Lakes); reported to breed in northeastern Nebraska but no specific records; northwestern South Dakota (Cave Hills); northern Idaho (Falcon); northwestern Oregon (Powder River Mountains, probably); probably western Nevada (Lake Tahoe); and south-central California (Greenhorn Mountains). **West** to central and western California (Greenhorn Mountains, Paicines, and Yreka); western Oregon (Pinehurst, Gold Hill, Depoe Bay, and Portland); western Washington (Mount Adams, Tacoma, and Blaine); and southwestern British Columbia (Friendly Cove and Tahsis Canal).

There are several records of the occurrence of this species in spring migration in southern Saskatchewan (Regina, East End, and Maple Creek); and in fall at Lake Kimawan, Alberta, west of Lesser Slave Lake. These records imply the existence of a breeding range north of any yet discovered.

Winter range.—The Nashville warbler and races are found in winter **north** to central Durango (Chacala); western Nuevo León (Monterrey) and southern Texas (Somerset and Matagorda County). **East** to southern Texas (Matagorda County, Rio Hondo, and Brownsville); eastern Puebla (Metlatoyuca); western Veracruz (Jalapa); Chiapas (Chicharras); and central Guatemala (Barillos, Panajachel, and San Lucas). **South** to Guatemala. **West** to western Guatemala (San Lucas and Sacapulas); Oaxaca (Tehuantepec); Guerrero (Acapulco); Colima (Manzanillo); and Durango (Durango and Chacla).

The Nashville warbler has been recorded as wintering occasionally in southern Florida, but in view of the extreme rarity of the species in southeastern United States it seems best to consider the record hypothetical until specimens are collected.

Like other species that winter regularly in the Tropics, the Nashville warbler can resist low temperatures as long as food is available. Evidence of this is seen in the daily presence of one in a garden in New York City from December 16, 1918, to January 9, 1919 (perhaps longer). Another was noted almost daily from January 1 to March 1, 1938, at a feeding table in Arlington, Va. The latter bird was caught and brought to the U. S. Biological Survey for confirmation of the identification, and was banded. On January 31, 1890, a specimen was picked up in Swampscott, Massachusetts, that had apparently been killed by a shrike about two weeks before.

The ranges as outlined apply to the entire species which includes two geographic races; the eastern Nashville warbler (*V. r. ruficapilla*) breeds from eastern Saskatchewan and Nebraska eastward; and the western Nashville warbler (*V. r. ridgwayi*) breeds west of the Rocky Mountains.

Migration.—Some early dates of spring arrival are: West Virginia—French Creek, April 23. District of Columbia—Washington, April 20. Pennsylvania—Beaver, April 25. New York—Canandaigua, April 25. Massachusetts—Taunton, April 24. Vermont—Rutland, April 27. Maine—Presque Isle, May 2. Quebec—Kamouraska, May 2. New Brunswick—Scotch Lake, May 8. Mississippi—Rosedale, April 26. Tennessee—Memphis, April 16. Kentucky—Bardstown, April 28. Indiana—Indianapolis, April 24. Ohio—Oberlin, April 19. Michigan—Ann Arbor, April 25. Ontario—Toronto, April 29. Texas—San Antonio, March 27. Arkansas—Delight, April 14. Missouri—St. Louis, April 21. Iowa—Davenport, April 26. Illinois—Chicago, April 25. Wisconsin—Madison, April 25. Minnesota—Red Wing, April 29. Manitoba—Winnipeg, May 2. Arizona—Tucson, April 6. Montana—Missoula, April 25. Idaho—Coeur d'Alene, April 29. California—Buena Park, March 3. Oregon—Prospect, April 20. Washington—Tacoma, April 23. British Columbia—Okanagan Landing, April 21.

Late dates of spring departure are: West Virginia—Wheeling, May 24. District of Columbia—Washington, May 20. Pennsylvania—Jeffersonville, May 20. Mississippi—Rosedale, May 6. Tennessee—Nashville, May 19. Kentucky—Bowling Green, May 19. Indiana—Richmond, June 1. Texas—Ingram, May 10. Arkansas—Monticello, May 9. Missouri—Columbia, May 28. Iowa—Grinnell, June 2. Illinois—Rockford, May 30. Kansas—Lake Quivira, May 21. Nebraska—Red Cloud, May 24. South Dakota—June 1. Arizona—Otero Canyon, Baboquivari Mountains, April 29. California—Cabezon, May 7.

Late dates of fall departure are: British Columbia—Okanagan Landing, September 13. Washington—Port Chehalis, October 11. California—Los Angeles, October 8. Idaho—Bayview, September 12. Montana—Bozeman, September 12. Arizona—Fort Verde, September 28. Manitoba—Shoal Lake, September 26. North Dakota—Fargo, October 15. South Dakota—Mellette, October 4. Nebraska—Blue Springs, October 1. Kansas—Lawrence, October 8. Minnesota—St. Paul, October 25. Wisconsin—Racine, October 6; Madison, November 1. Iowa—Marshalltown, October 14. Missouri—Columbia, October 19. Arkansas—Winslow, October 14. Texas—Cove, November 15. Ontario—Ottawa, October 7. Michigan—Sault Ste. Marie, October 7. Illinois—Springfield, October 2. Ohio—Toledo, October 29. Kentucky—Lexington, October 16. Tennessee—Memphis, October 3. Mississippi—Deer Island, October 16. Quebec—Hatley, October 18. Maine—Portland, October 13. New Hampshire, Center Ossipee, October 23. Massachusetts—Danvers, October 12. New York—New York, October 17. Pennsylvania—Philadelphia, October 17. District of Columbia—Washington, October 14. West Virginia—Bluefield, October 19.

Early dates of fall arrival are: California—Los Angeles, August 9. Arizona—Patagonia, August 8. North Dakota—Rice Lake, August 18. South Dakota—Yankton, August 2. Kansas—Lake Quivira, August 31. Iowa—Iowa City, August 18. Missouri—Montier, August 8. Arkansas—Winslow, September 8. Texas—Rockport, September 1. Illinois—Glen Ellyn, August 16. Indiana—Bloomington, August 26. Ohio—Cleveland, August 2. Kentucky—Versailles, August 13. Tennessee—Marysville, September 1. Massachusetts—Martha's Vineyard, August 17. New York—Rhinebeck, August 13. Pennsylvania—Pittsburgh, August 28. District of Columbia—Washington, September 5. West Virginia—French Creek, September 7.

The Nashville warbler is a rare species in the lower Mississippi Valley; there are only three records for Louisiana; and it is almost unknown in the Atlantic States south of the Chesapeake Bay.

Casual records.—Four specimens have been collected in Greenland: One at Godthaab, about 1835; two at Fiskenaes, October 10, 1823, and August 31, 1840; and one marked "West Greenland," between 1890 and 1899. The three latter were all immature birds. A specimen was collected in Bermuda on September 16, 1907.

Egg dates.—Maine: 27 records, May 8 to August 7; 15 records, May 27 to June 14, indicating the height of the season.

Minnesota: 11 records, May 7 to June 15.

Quebec: 32 records, May 28 to July 4; 18 records, June 19 to 29.

California: 23 records, May 17 to July 30; 12 records, May 21 to June 5 (Harris).

VERMIVORA RUFICAPILLA RIDGWAYI van Rossem

WESTERN NASHVILLE WARBLER

HABITS

This western form of our well-known eastern Nashville warbler, often called the Calaveras warbler, was discovered by Robert Ridgway in the East Humboldt Mountains, Nev., on September 6, 1868, and given the subspecific name *gutturalis.* He (1902) describes it as similar to the eastern bird, "but olive-green of rump and upper tail-coverts brighter, more yellowish, yellow of under parts brighter, lower abdomen more extensively whitish, and greater wing-coverts lighter, more yellowish olive-green." He gives as its range: "Western United States, breeding on high mountains, from the Sierra Nevada (Calaveras Co., California) to British Columbia (Vernon, Nelson, Okanogan district, etc.), eastward to eastern Oregon (Fort Klamath), northern Idaho (Fort Sherman), etc.; southward during migration to extremity of Lower California, and over western and northern Mexico, and southeastward to Texas (San Antonio; Tom Green County; Concho County)." The 1931 A. O. U. Check-List says that this form winters "in Mexico south to Puebla, Oaxaca, Guerrero, Jalisco, and Colima."

Dr. Walter K. Fisher wrote to Dr. Chapman (1907): "The Calaveras Warbler is a characteristic denizen of the chaparral and is found on both slopes of the Sierra Nevadas about as far south as Mt. Whitney. It frequents the belts of the yellow, sugar, and Jeffrey pines, and ranges up into the red fir zone. During the height of the nesting season one may see them flitting about among thickets of manzanita, wild cherry, huckleberry, oak and buck brush, almost always in song; and while the female is assiduously hunting among the dense cover of bushes, the male is often singing in a pine or fir, far above mundane cares. * * * I have observed this Warbler at lower altitudes on the west slope among small black oaks, in company with Hermit Warblers."

Dr. Wilfred H. Osgood (1896) first saw it in the Sierras at 3,500 feet elevation, but more commonly at 3,700 feet. "At 5,000 feet we found them most common, and from 7,000 to 9,000 feet they gradually disappeared, apparently going as high up as the black oak, in which trees they were generally seen, skipping about in search of insects."

Grinnell and Storer (1924) say: "The Calaveras Warbler is common during the summer months in the black oaks and maples along each side of the Yosemite Valley and in similar situations elsewere on the western flank of the Sierra Nevada. Among all the warblers to be seen in the Yosemite Valley during the summer months the present species is the only one which does not forage and nest in the same niche. The Calaveras seeks its food and does its singing well up in trees, but places its nest immediately upon the ground."

C. W. and J. H. Bowles (1906) write of its haunts in Washington:

> Like the hermit warbler, a bird of the higher altitudes in the mountains of California, the Calaveras warbler, on reaching the cooler climate of the northwest, is to be found as a rule only on the driest prairies. Here the birds frequent the scattered clumps of young oaks and fir trees that have reached a height of some three or four feet, and which border the large tracts of dense fir timber. It is a noteworthy fact that, while these birds are not often to be found more than a hundred yards outside of the forests, they are seldom or never seen inside of the dividing line where the heavy timber meets the prairie. Also they do not encroach upon the hillside territory of the lutescent warbler, which bird in turn does not appear on the prairies but confines itself to the brush-covered uplands.

Nesting.—Dr. Osgood (1896) found three nests of the western Nashville, or Calaveras, warbler near Fyffe in the Sierras; two of these were concealed under dead leaves, one of which was partially concealed by a little sprig of cedar at the foot of a cedar stump, and the other was under a little tuft of "mountain misery"; the third was in a thick patch of "mountain misery" and was "well embedded among the roots of this little shrub, and shaded by its thick leaves."

In the Yosemite Valley, Grinnell and Storer (1924) found a nest in what must be an unusual situation:

> The location was only about 75 feet from the much traveled south road on the Valley floor and at the base of the talus pile of huge boulders. The nest was in the face of one of the larger of these boulders, partly in a diagonal fissure. It was on the north side of the rock and so never received any direct rays of sunlight. The whole face of the boulder was covered densely with yellow-green moss which in places was overlaid by olive-gray lichens. The nest was 43 inches from the base of the rock and about 60 inches from the top. Another nest was found in a hollow of the ground at the base of an azalea bush, near an old road

along the hillside. The creek itself was about 50 feet distant. This nest was 3 inches across the outside and about 2 inches high, the cavity being 1¼ inches deep. Strips of bark of the incense cedar, plant fibers, and horsehair comprised the building material.

The Bowles brothers (1906) say that the nests are very much like those of the eastern Nashville warbler, as taken by them in Massachusetts. In Washington, "the site chosen is usually at the base of a very young oak, or fir, tho on one occasion we found one built under some blackberry vines at the base of a large fir stub. The nests are sunk well into the ground or moss, and are so well concealed as to defy discovery unless one flushes the bird."

Eggs.—The eggs of the western Nashville warbler are practically indistinguishable from those of the eastern form. The measurements of 40 eggs average 15.3 by 12.2 millimeters; the eggs showing the four extremes measure 16.6 by 13.2, 14.3 by 11.9, and 16.0 by 11.5 millimeters (Harris).

We have no information on the incubation of the eggs or care of the young. The changes in plumage parallel those of the eastern bird. Very little seems to be known about the exact food of the Calaveras warbler, and its voice seems to be the same as that of the Nashville, but the following accounts of its habits seem worth quoting. Grinnell and Storer (1924) write:

> The forage range of this warbler lies chiefly in trees other than conifers. Such trees as the black oak and big-leafed maple renew their foliage every spring and the Calaveras Warblers find excellent forage in the insects and larvae which feed upon this tender new leafage during the spring and summer months. Less often these birds may be found in golden oaks and occasionally in Douglas spruces. They usually forage 25 to 40 feet above the ground, keeping within the stratum of new foliage, but they have been seen as low as 10 feet and as high as 70 feet above the earth. When within the foliage their yellow and green coloration makes it difficult to locate them, especially as the birds do not move about as rapidly as some of the other warblers. At times a Calaveras Warbler will poise on rapidly beating wings to capture some insect otherwise out of reach.

Dr. J. C. Merrill (1888) calls them "restless, shy, and very difficult to shoot, and says further, "When alarmed, as they very easily are, the males move rapidly through the trees, often flying a hundred yards or more at once, and were it not that their constant song indicates their movements, it would be impossible to follow them. I have frequently followed one for half an hour or more before I could even catch a glimpse of it, and my pursuit of any particular one was more often unsuccessful than the reverse. * * * I have never found a land bird more wary and difficult to shoot. But as soon as the young leave the nest this extreme shyness disappears, and the parents are readily approached and observed as they busily search for food for their young family."

Dr. William T. Shaw, who collected a specimen of this warbler in northwestern Washington, says in his notes: "This warbler, a singing male, was noticeably a percher upon high, isolated cedar poles when singing, having three or four favorite ones in his territory, which was a hillside grown to a height of about 15 feet with second-growth deciduous trees, following fire. He sang from a height of from 30 to 40 feet up near the top of these old widely-scattered, fire-blasted, weather-bleached trees, clearly out in the open and isolated from green sheltering foliage beneath him, in such a location as one is accustomed to seeing lazuli buntings perch when they sing." Dr. Shaw thought the first part of the song suggested that of Macgillivray's warbler, and the latter notes reminded him of "those heard among the inspirational notes in the song of the lazuli bunting."

The Bowles brothers (1906) say that, in the spring, the males have at times a very pleasing habit while singing, "that of hovering thru the air for a distance of fifteen or twenty yards. The manner of flying at these times is very slow and closely resembles that of one of the marsh wrens, but the beak is turned upwards and the feathers on the swelling throat separate until it seems almost certain that the bird will sing himself into some serious bodily mishap."

VERMIVORA VIRGINIAE (Baird)

VIRGINIA'S WARBLER

Plate 18

HABITS

This warbler was discovered by Dr. W. W. Anderson, at Fort Burgwyn, New Mexico, and was described by Baird, in a footnote in The Birds of North America, by Baird, Cassin, and Lawrence (1860). The footnote occurs under the explanation of plates in the second volume. The warbler was named for Mrs. Virginia Anderson, wife of the discoverer.

Its range during the breeding season covers portions of Nevada, Utah, Colorado, Arizona, and New Mexico, mainly in the mountain regions, and it retires to Mexico for the winter. It seems to be more abundant in Colorado than elsewhere, breeding from the foothills, where it is a characteristic bird and perhaps the most abundant of the wood warblers, up to 7,500 to 8,000 feet in the mountains. On the spring migration, it is abundant along the valley streams, among the cottonwoods and willows, or sometimes among the pines; but in the summer it is found among the low scrub oak brush on the hillsides.

Bailey and Niedrach (1938) write attractively of Virginia's warbler in its Colorado haunts:

> In the broken prairie where the yellow pines have taken their stand upon the crest of the tableland, and in the rocky canyons clothed with the scraggly scrub oaks slipping down to narrow grass-grown creek-bottoms, Virginia's Warbler chooses its nesting grounds.
>
> Plants seem to burst into life during the early weeks in May. * * * The flowers of the scrub oaks tinge the hillsides with a greenish-yellow bloom; the green of bursting leaves and grasses soon blends with the nodding blossoms of the pasque-flower; the beautiful pink plume sways on the hillside, and yellow blossoms of the Oregon grape thrust forth among the holly-like leaves, making one think of flowering Christmas wreaths. It is then that the Virginia's Warblers are at the height of their activity. Their colors are the grays and yellows of the new vegetation. The males perch among scrub-oak branches and yellow pines, where they are usually concealed, and do their utmost to outsing their towhee neighbors.

In Nevada, Ridgway (1877) first observed this warbler "among the cedar and piñon groves on the eastern slope of the Ruby Mountains. * * * On the Wahsatch and Uintah Mountains it was more abundant, being particularly plentiful among the scrub-oaks on the foot-hills near Salt Lake City. They lived entirely among the bushes, which there were so dense that the birds were difficult to obtain, even when shot."

In the Charleston Mountains, Nev., according to A. J. van Rossem (1936), "the distribution appeared to be limited to the so-called Upper Sonoran associations of mahogany and Gambel oaks, and therefore the species is considered characteristic of that zone, although the extremes of altitude at which it was found were 6,300 and 9,000 feet. Because of the relative scarcity of oaks, by far the greater number were found in mahogany which here grows as low, dense forest, instead of in the more familiar shrub form in which it is usually known."

In the Great Basin region, Dr. Jean M. Linsdale (1938) found Virginia's warblers in a variety of situations, such as "in sage on rocky, piñon-covered slope 100 yards from a stream; in sage on top of ridge; at tip of mountain mahogany tree; in plum thicket; singing and foraging through upper foliage of tall birches close to creek; in cottonwoods and piñons close to creeks; singing in dead shrub 10 feet high at base of rock slide; in aspen; in thickets of sage, elder, *Ephedra*, and *Symphoricarpos;* in willow; on ground among rocks at crest of ridge." The altitudes ranged from 6,500 to 8,000 feet, with the largest number between 7,000 and 7,500 feet.

In southern Arizona, this warbler, according to Mr. Swarth (1904)—

> proved to be very abundant during the spring migration, particularly in the lower parts of the mountains; but the most of them seem to go farther north, and but

few, compared with the numbers seen in April and the early part of May, remained through the summer to breed. The earliest arrival noted was on April 10th and soon after they were quite abundant, mostly in the oak region below 5000 feet, remaining so throughout April and up to the first week in May, at which time the migrating birds had about all passed on. All that were seen after that I took to be breeding birds, for they gradually moved to a higher altitude, (6000 to 8000 feet) and were nearly all in pairs. About the middle of April, 1902, I found a few *virginiae*, together with other migrating warblers, in the willows along the San Pedro River, some fifteen miles from the mountains.

Nesting.—Ridgway was evidently the first to record the nest of Virginia's warbler, finding it near Salt Lake City on June 9, 1869. "The nest was embedded in the deposits of dead or decaying leaves, on ground covered by dense oak-brush. Its rim was just even with the surface. It was built on the side of a narrow ravine at the bottom of which was a small stream. The nest itself is two inches in depth by three and a half in diameter. It consists of a loose but intricate interweaving of fine strips of the inner bark of the mountain mahogany, fine stems of grasses, roots, and mosses, and is lined with the same with the addition of the fur and hair of the smaller animals" (Baird, Brewer, and Ridgway, 1874).

Shortly afterwards, a nest was found on June 1, 1873, in Colorado, by C. E. Aiken. It was reported by Aiken and Warren (1914) as "the first nest of this species known to science. * * * This was sunk in the ground in a tuft of bunch grass growing in a clump of oak brush, with the dead grass hanging over and completely concealing the nest, which was reached through a small round hole like a mouse hole through the protecting grass."

Dr. Linsdale (1938) reports a nest found in Nevada, at an elevation of 7,700 feet, that "was at the lower edge of a clump of grass 20 inches tall and 2 feet across. The surrounding hillside was of small rocks lying at a maximum angle of rest. A few similar grass clumps were scattered near, about 10 feet apart. The surrounding trees were mountain mahogany and chokecherry. The nest was composed entirely of grass and was in a depression in the loose soil. It was well concealed by dead grass at the base of the tuft."

In the Huachuca Mountains, Ariz., Mr. Swarth (1904) found a nest that "was built on a steep sidehill about ten feet from a much traveled trail, and was very well concealed; being under a thick bunch of overhanging grass, and sunk into the ground besides, so as to be entirely hid from view. This was at an elevation of about 8,000 feet, which seems to be about the upward limit for this species in this region."

We found Virginia's warbler fairly common there in the middle reaches of the canyons, around 7,000 feet, and found a nest being built at the base of a bush of mountain misery; Mr. Willard collected it with a set of three eggs on June 4, 1922; it was made of leaves and strips of bark and was lined with horsehair.

Another nest before me, from the Huachucas, has a foundation of moss and lichens, dry leaves, and strips of cedar mark, over which are finer strips of the bark and shreds of dry weed stalks and grasses, with a lining of still finer fibers; it is a shallow nest, its diameter being 3 by 3½ inches outside and 2 inches inside.

Eggs.—While 4 eggs seem to constitute the usual set for Virginia's warbler, as few as 3 and as many as 5 have been reported. These are ovate to short ovate and only slightly lustrous. They are white, finely speckled or spotted with shades of reddish brown, such as "chestnut" and "auburn," intermingled with faint specks of "pale vinaceous-drab." Some eggs are profusely spotted over the entire surface, while others have the markings concentrated at the large end. The measurements of 40 eggs average 15.9 by 12.4 millimeters; the eggs showing the four extremes measure 17.0 by 12.4, 16.0 by 13.0, 14.2 by 12.2, and 16.3 by 11.2 millimeters (Harris).

Young.—On the period of incubation and on the development and care of the young we have no information except the following observations of Bailey and Niedrach (1938): "The hatching time of many species of Colorado birds seems to coincide with an abundance of larvae feeding upon plants among which the birds are nesting. We have noticed time and again, that pests are numerous upon the vegetation when the fledglings are in the nest, but a few weeks later, after the little fellows have taken wing and are able to move to other parts, the caterpillars have gone into the pupa stage." At a nest they were watching, they observed that both parents shared the work of feeding the young, averaging a trip every 6 minutes.

A. J. van Rossem (1936) took young birds that were not fully grown on July 10, and others on July 13 that had nearly completed the postjuvenal molt, from which he inferred that two broods might be raised in a season. H. S. Swarth (1904) noted that the young birds began to appear in the Huachuca Mountains about the middle of July, after which both old and young birds moved down into the foothills.

Plumages.—The young Virginia's warbler in juvenal plumage is plain grayish brown above; the throat, chest, and sides are paler brownish gray; the abdomen and center of the breast white; the upper and under tail coverts are dull greenish yellow; there is no chestnut crown patch; and the greater and median wing coverts are tipped with dull buffy. The sexes are alike.

The postjuvenal molt begins early in July and is often complete before the end of that month. The first winter plumage is similar to that of the adult female at that season. In this plumage the sexes are not very different, and the crown patch is not much in evidence or is altogether lacking in the young female; both sexes are browner and with less yellow than in the adult plumage, and the female is duller than the male.

A partial prenuptial molt occurs between February and May, mainly about the head, during which the chestnut crown patch is at least partially assumed and the young birds become almost indistinguishable from adults. There is, however, considerable individual variation in the advance toward maturity.

Subsequent molts consist of a complete postnuptial molt in July and August, and a partial prenuptial molt in early spring. The adult male in the fall is browner above and on the flanks, and the yellow on the chest is duller than in the spring, while the chestnut crown patch is concealed by brownish gray tips. The female, also, is browner than in the spring, with little if any yellow on the chest and with the crown patch similarly concealed. In spring birds there is much individual variation, perhaps owing to age, in the amount of yellow on the breast, throat, and chin. Some females are nearly as brightly colored as are the duller males, some have very little yellow on the chest and some lack the chestnut crown patch.

Food.—Our information on the food of Virginia's warbler is limited to the observation of Bailey and Niedrach (1938) who saw a pair of these warblers feeding their young on the caterpillars that eat the foliage of the trees and shrubs on their nesting grounds. It is significant that after these caterpillars are no longer available the warbler leaves its breeding haunts and moves down into the foothills, perhaps in search of other food; and it would be interesting to learn what that food is. It has been seen foraging on the ground, as well as in the foliage, and flying up into the air to capture insects on the wing.

Behavior.—Virginia's warbler is a shy, retiring species, spending most of its time not far above the ground in the thick underbrush, where it is not easily seen, as its colors match its surroundings. It is also very lively and active, almost constantly in motion, except when it mounts to the top of some dead bush or small tree to sit and sing.

Voice.—Dr. Chapman (1907) quotes C. E. Aiken as follows: "The male is very musical during the nesting season, uttering his *swee* ditty continually as he skips through the bushes in search of his morning repast; or having satisfied his appetite, he mounts to the top of some tree in the neighborhood of his nest, and repeats at regular intervals a song of remarkable fulness for a bird of such minute proportions." Henry D. Minot (1880) calls the "ordinary note, a sharp *chip;* song, simple but various (deceptively so) ; common forms are *ché-we-ché-we-ché-we-ché-we*, *wit-a-wít-wít-wít* (these terminal notes being partially characteristic of *Helminthophagae*) and *che-wé-che-wé-che-wé*, *ché-a-ché-a-ché*". Dr. Linsdale's (1938) comments on singing males follow:

> The song varied from 7 to 10 notes, being usually 8, and it occupied about 3 seconds. At the beginning the notes were slow and they came more rapidly at the end. About half a minute elapsed between songs." Another bird "sang

14 times in 3 minutes and 10 seconds. * * * Singing perches on dead limbs that were rather exposed were the rule, but they were not often as high as the tops of tall trees. * * * On June 16, 1930, near Kingston Creek, 7500 feet, a singing male was followed for an hour, beginning at 7:30 a. m. It sang about every 30 seconds. The territory over which it moved was surprisingly large, estimated as extending 400 yards along the cañon slope and vertically about 150 yards, from near the stream to the base of the broken cliffs. * * * The song, compared with that of the Tolmie warbler had a more rapid rhythm and the notes were thinner and weaker. It could be distinguished from that of the Audubon warbler by the lack of rising inflection at the end. The song was represented by the observer (Miller) as *zdl-zdl-zdl-zdl, zt-zt-zt-zt.*

Field marks.—Virginia's warbler, with its plain gray upper parts, is an inconspicuous bird, and its shy, retiring habits make it difficult to observe. The chestnut crown patch is not prominent and is often invisible. The yellow on the chest and throat of the male is quite variable and in the female and young much reduced or lacking. The best field marks are the dull yellow rump and upper and under tail covers, which are more or less conspicuous in old and young birds at all seasons.

Enemies.—O. W. Howard (1899) says that "the nests of the bird, like those of other ground-nesting birds of this locality, are destroyed by jays and snakes. The jays steal both eggs and young. Often a whole band of these winged wolves will sweep down on a nest and in less time than it takes to tell it they will devour the contents and destroy the nest, the pitiful notes of the helpless parents being drowned by the harsh notes of the marauders."

Frank C. Cross writes to me that Robert J. Niedrach showed him a nest of this warbler that contained a young cowbird and one young warbler.

Winter.—By the last of August or early September, Virginia's warblers have retired from their northern breeding haunts, to spend the winter in southern Mexico. Dr. C. William Beebe (1905) writes: "Occasionally in the mornings, numbers of tiny grayish warblers came slowly down the walls of the *barranca*, feeding as they descended, taking short flights, and keeping close to ground among the dense underbrush. These birds lingered at the camp for a time, and then, with soft, low chirps, all passed on to the water, where they alighted on the sand and drank. Then, as if at some silent signal, all flew up and returned quickly, still keeping close to the ground, zig-zagging their way upward in a long line, like tiny gray mice." These were, of course, Virginia's warblers.

DISTRIBUTION

Range.—Western United States to Southern Mexico.

Breeding range.—Virginia's warbler breeds **north** to central eastern California (White Mountains); central and northeastern Nevada

(Kingston Creek, Ruby Mountains, and East Humboldt Mountains); northern Utah (Salt Lake City, Parley's Park, Packs Canyon, and Ashley); possibly southeastern Idaho (Joe's Gap, Bear Lake County; one specimen from Bancroft, Bannock County); and northern Colorado (probably Little Snake River, Moffat County, and Estes Park). **East** to the eastern slope of the Rocky Mountains in Colorado (Estes Park, Denver, Manitou, Fountain, and Beulah); in migration has occurred east to Limon, and Monon in Baca County close to the Kansas line; and central New Mexico (Tierra Amarilla, Lake Burford, Sandia Mountain, and Apache, probably). **South** to southwestern New Mexico (Apache); and southeastern Arizona (Paradise and the Huachuca Mountains). **West** to southeastern and central Arizona (Huachuca Mountains, Santa Catalina Mountains, and Prescott); and eastern California (Clark Mountain and White Mountains; casually in migration to Lemon Grove).

Winter range.—In winter Virginia's warbler is found in west central Mexico from northern Jalisco (Bolanas); and Guanajuato (Guanajuato), to Morelos (Yautepec); and Guerrero (Talpa and Chilpancingo).

Migration.—A late date of spring departure is: Sonora—Moctezuma, May 10.

Early dates of spring arrival are: Texas—Socorro, April 20. New Mexico—Cooney, April 10. Colorado—Estes Park, May 2. Arizona—Madera Canyon, Santa Rita Mountains, April 2. Utah—Vernal, May 5. Nevada—South Twin River, April 30.

Late spring migrant in Brewster County, Tex., May 13.

Late dates of fall departure are: Utah—Vernal, September 20. Arizona—Tombstone, September 11. Colorado—Boulder, September 21. New Mexico—Koehler Junction, September 11. Texas—El Paso, September 16.

Early dates of fall arrival are: Arizona—Toprock, July 23. Texas—Toyavale, August 21. Sonora—Guadalupe Canyon, August 31.

Casual records.—Two specimens of Virginia's warbler have been taken in western California: in San Diego County, on September 3, 1931; and at Prisoner's Harbor, Santa Cruz Island, on September 8, 1948. Virginia's warbler has been reported as occurring in Nebraska and Kansas, but there is no record of a specimen having been taken in either State.

Egg dates.—Arizona: 10 records, May 17 to June 21; 5 records, May 25 to June 4.

Colorado: 6 records, June 1 to 26.

Nevada: 3 records, June 8 to 15.

VERMIVORA CRISSALIS (Salvin and Godman)

COLIMA WARBLER

Contributed by Josselyn Van Tyne

HABITS

Described in 1889 from a single specimen collected by W. B. Richardson in the Sierra Nevada de Colima, Mexico, this handsome warbler was, in 1932, still known from only a dozen museum specimens, and not a word had been recorded on its habits. In that year a University of Michigan expedition found the Colima warbler to be common in the higher forests of the Chisos Mountains of southwestern Texas and made the first discovery of its nest and eggs. The basis for the inclusion of this warbler in the A.O.U. Check-List had been a single specimen collected by Frederick M. Gaige in the Chisos in 1928 (Van Tyne, 1929).

The range of the Colima warbler has been recorded only very sketchily, but Bangs (1925) was probably correct in surmising that the specimens from southern Mexico (Colima and Michoacán) were migrant birds. The closely related Virginia's warbler, which nests in the Rocky Mountain States, winters mainly in Michoacán, Guerrero, and Jalisco. Recently R. T. Moore (1942) added a second, more southerly, locality in Michoacán and one in eastern Sinaloa to the known southern range of the Colima warbler. The breeding range is apparently restricted to the highlands of northeastern Mexico and the Chisos Mountains of southwestern Texas. In Texas the Colima warbler occurs at altitudes between 6,000 and 7,500 feet (Van Tyne, 1936); in Coahuila, apparently, only above altitudes of approximately 7,500 feet (Burleigh and Lowery, 1942). Records from the southern part of its range, however, show a greater altitudinal spread. The type specimen was taken in Colima at about 8,000 feet, and R. T. Moore (1942) reports two November specimens, one taken at 9,500 feet in northeastern Michoacán, the other at 5,200 feet in Sinaloa. These represent the extremes of the known altitudinal range.

Courtship.—Mating behavior has been observed during the first few days of May and sets of eggs noted May 15 (just completed) and May 20 (highly incubated). The only recorded specimen in juvenal plumage was collected July 20. Peet observed pursuit behavior in the Chisos Mountains on May 4 (within a few days of nest building), which may have had some courtship significance, but nothing definite is known of the courtship habits. Sutton noted copulation twice on May 1 in the Chisos, and the gonads of specimens collected that day were much enlarged; there was no indication that the females had begun incubating.

Nesting.—Two nests, both in the Chisos Mountains, have been described. The first (discovered in 1932) was lodged between small rocks and deeply imbedded in dead oak leaves on the sloping bank of a dry stream bed. A dense ground cover of vines and other herbaceous plants arched completely over it, leaving an entrance only on the northwest side, toward the stream. The nest had a basic structure of loosely woven fine grasses, the outside reinforced with pieces of green moss and the rim with strips of cedar bark; the cavity (5 centimeters across the rim and 4 centimeters deep) was lined with fine grass, a little fur, and a few hairs (Van Tyne, 1936). The other nest, which was "on the ground, under a little bunch of oak leaves, at the edge of a talus slope, almost at the very base of the cliffs" (Sutton, 1935), was similar, but its basic structure included dry leaves, and the site was concealed by only a partial canopy of leaves (Van Tyne and Sutton, 1937).

Nest building was observed in the Chisos Mountains on May 7, 1932 (Van Tyne, 1936):

> As I was crossing the dry stream bed about a hundred yards below Boot Spring, I suddenly saw within twenty-five feet of me a female warbler with nest material in her bill. I stopped instantly and, remaining motionless, was greatly relieved to see the warbler continue undisturbed by my presence. In a moment she dropped to the ground and entered the nest, which was on the sloping right bank of the stream about six feet back from the margin of the rocky stream bed. After working for about twenty seconds the warbler left the nest and flew down the stream bed a hundred and fifty feet. In twelve minutes she was back with more nest material to repeat the performance. Subsequent excursions for building material during the ensuing hour were of three, twelve, six, and twenty-two minutes' duration. Each time she worked at the nest only fifteen to twenty seconds, until the last trip (at 11:43 A. M.) when she worked about two minutes and then departed, probably to feed, for she did not return again while I watched. Each trip to the nest had been made undeviatingly, without any hesitation, from the stream bed or from the forest to the west. Alighting almost directly above the nest, without a pause she dropped through the branches by three or four stages and promptly entered the nest, placed the material, and snuggled down working it into place. After a few moments she seemed to have completed this to her satisfaction, and, leaving the nest, she flew up to the branches ten or twelve feet above, fed for a few moments on the insects among the fresh green leaves of the little oaks and maples, and went away for more material.
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> When it was evident that the nest building was over for the time I went over to the nest and, examining it more closely, found that it was nearly built. The following day, May 8, it seemed to be finished.

Eggs.—Two complete clutches have been found, each containing four eggs. Four eggs collected and measured were 18 by 13.3, 18 by 13.5, 18 by 13.5, and 18.5 by 14 millimeters. They were creamy white, speckled, and blotched in a wreath at the larger end with "vinaceous fawn," "light brownish drab," and "cinnamon drab."

Egg laying, in the one instance observed, was at daily intervals (May 12–15); the first egg was laid four days after completion of the nest. Incubation had begun May 16, the day after the last egg was laid. The length of the incubation period is not known. Females collected on May 12 (Peet), May 17 (Van Tyne), and May 20 (Sutton) had well-marked incubation patches; males collected at the same time had no patch.

Plumages.—The Colima warbler differs from its nearest relative, the Virginia's warbler, in being larger; darker, less gray, above; crown paler; rump and upper tail coverts darker and richer in color; yellow of throat and breast absent or, if present, more green and more diffuse; sides and flanks more brownish; crissum darker, more aniline yellow; sexes much more nearly alike. The adult female Colima warbler is slightly darker than the male and is more brown below. It is apparently never yellow on the breast.

The juvenal plumage (known from only one specimen) differs from the adult plumage in lacking the crown spot and in having two buffy wing bars. The rump is also much more yellow (less green) and the crissum is more yellow (less orange). The young Colima warbler differs from the young Virginia's warbler in having a larger bill, darker plumage, and a less ochraceous rump.

The fall plumage differs from that of the spring in being "darker and browner throughout, the gray of head a good deal obscured by deep olive or light brownish olive; crown patch orange rufous; under parts darker with whitish area in middle of belly more distinct and under tailcoverts duller, more nearly aniline yellow" (Bangs, 1925).

George Miksch Sutton's fine color plate (Van Tyne, 1936, frontispiece) of the Colima warbler is apparently the only published figure of the species.

Behavior.—In Texas, the Colima warbler was observed feeding on insects (which were not identified), but nothing further has been recorded about its food. All observers seem to agree that it is not a shy bird, although in its preferred cover, the female seems elusive and nests are difficult to find. Sutton has remarked that they are "rather deliberate, even vireo-like in their movements" (Van Tyne and Sutton, 1937). In the Chisos Mountains, they frequented especially the young maples and deciduous oaks along the banks of the dry, boulder-strewn stream bed, and elsewhere on the steep mountain slopes their preference for clumps of small oaks was noted.

Voice.—The call note of the Colima warbler is a very sharp, almost explosive *psit.* Its common song is a continuous trill, like that of the chipping sparrow, but shorter (lasting 3 to 4 seconds), more musical, and ending with two separate notes slightly lower in scale. A second, rarer, and more varied song is so clear that it can be heard for three or four hundred feet through the woods although it does not seem loud when heard from nearby. It is perhaps this song that Brandt (1940) describes as resembling the song of the eastern redstart. E. C. Jacot (MS.) reports that the males usually start singing when "a person approaches the territory of a pair, and continues to sing until the intruder has passed." In the Chisos Mountains, Tex., the males were persistent singers. Once several sang even after a dense fog had silenced most other species. They sang usually from bushes and small trees between periods of feeding and moving about but sometimes remained for a while on a higher perch (up to 20 feet), singing at frequent intervals.

DISTRIBUTION

Range.—Chisos Mountains, Tex., and mountains of northeastern Mexico; probably winters in Colima, Michoacán, and Sinaloa.

The Colima warbler has been recorded from: Texas (Chisos Mountains); Coahuila (Sierra Guadalupe and Diamante Pass); Tamaulipas (Miquihuana); Michoacán (Patamba and Sierra Ozumatlan); Sinaloa (5 miles north of Santa Lucia); Colima (Sierra Nevada).

Egg dates.—Texas: 2 records, May 15 and 20.

VERMIVORA LUCIAE (Cooper)

LUCY'S WARBLER

PLATES 18, 19

HABITS

Dr. J. G. Cooper discovered this tiny and inconspicuous warbler at Fort Mojave, on the Arizona side of the Colorado River, in the spring of 1861, and named it in honor of Miss Lucy Baird, daughter of Prof. Spencer F. Baird. It might well have been named the mesquite warbler, as its distribution coincides very closely with that of this tree, which seems to furnish its favorite home, most of its nesting sites, and much of its foraging area.

Harry S. Swarth (1905) wrote of conditions then existing:

> South of Tucson, Arizona, along the banks of the Santa Cruz River, lies a region offering the greatest inducements to the ornithologist. The river, running underground for most of its course, rises to the surface at this point, and the bottom lands on either side are covered, miles in extent, with a thick growth of giant mesquite trees, literally giants, for a person accustomed to the scrubby bush that grows everywhere in the desert regions of the southwest, can hardly believe that these fine trees, many of them sixty feet high and over, really belong to the same species. This magnificent grove is included in the Papago Indian Reservation, which is the only reason for the trees surviving as long as they have, since elsewhere every mesquite large enough to be used as firewood has been ruthlessly cut down, to grow up again as a scraggly bush.

But this magnificent forest did not long remain in its pristine glory. When I was in Arizona with Frank Willard in 1922, we had looked forward with keen anticipation to visiting the mesquite forest, where he had told me that we should find a thick stand of big trees covering a large area, and some wonderful bird life. We were disappointed in the forest, for the Papago Indians had been cutting down the larger trees unmercifully and had made a network of cart roads all through it for hauling out the firewood. There were only a few large trees left, more or less scattered, and between them many open spaces in which were thickets of small mesquites and thorn or patches of medium-sized mesquites and hackberries. But we were not disappointed in the bird life, for here and in other parts of Pima County, wherever there were mesquites, we found Lucy's warblers really abundant and breeding. The forest fairly teemed with bird life, from the graceful Mexican goshawks soaring overhead to the Gambel's quails whistling on the ground. The constant cooing of the white-winged doves was almost too monotonous, but the rich song of the Arizona cardinal, mingled with the voices of the orioles, towhees, wrens, and vireos made a delightful chorus, among which the sweet song of Lucy's warbler was prominent.

Dr. Joseph Grinnell (1914) writes, referring to the Colorado Valley: "On the California side, both at Riverside Mountain and above Blythe, Lucy warblers were numerous, and very closely confined to the narrow belt of mesquite. The singing males, each representing the forage area and nesting site of a pair, were spaced out very uniformly, so that an estimated strip of about 200 yards in length belonged to each. The birds foraged out to a limited extent from the mesquites towards the river into the arrowweed and willows, and away from the river at the mouths of washes into the ironwoods and palo verdes. But the metropolis was always most emphatically the mesquites."

Nesting.—M. French Gilman (1909) had considerable experience with the nesting habits of Lucy's warbler along the Gila River in Arizona, of which he says:

> Four general types of nesting sites were noticed, in the following order of frequency: in natural cavities, under loose bark, in woodpecker holes, and in deserted Verdins' nests. Of 23 nests observed, 12 were in natural cavities, 4 under loose bark, 4 in woodpecker holes, and three in Verdins' nests. Natural cavities were of various kinds. Some were where a limb had been broken off; others in the crack made by a large branch splitting from the trunk; and again a decayed spot furnisht a sufficient hollow to conceal the nest. In all cases the site was in a sheltered or protected position; that is, the trunk leaned enough to shade the entrance from above. A mesquite tree was usually selected, tho others were taken. Of the nests observed, 15 were in mesquites, 5 in palo verde, 2 in ironwood, and one in catsclaw. * * *

> The nests were small and compact and well hidden in their cavity. Only twice did protruding material betray the location. In one case nesting material protruded from a woodpecker hole, and the other was a bulky nest that showed from each side of a split branch. This last nest I thought must belong to a House Finch, but investigation showed warbler ownership. Nests were made of bark, weeds, and mesquite leaf-stems, and lined with fine bark, horse and cow hair, a few feathers and sometimes a little rabbit fur. The site averaged six and one-half feet from the ground, the lowest being 18 inches and the highest 15 feet. * * *
>
> In nest-building the female seems to do all the work, her mate sometimes accompanying her on trips to and from the tree, but more frequently flitting about the tops of adjacent trees, occasionally uttering his little warble. One pair I watcht had a nest in a Texas Woodpecker hole in a palo verde tree about 15 feet from the ground. The female brought material to the nest three times in two minutes, then a seven minute interval, followed by two trips in three minutes. The male accompanied her on two trips then made himself scarce. He indulged in no singing and both birds were silent, tho in many cases one or both gave the call note at intervals.

Others have mentioned nests of Lucy's warblers in verdins' nests, probably all old winter nests of the male verdin, relined to suit the warbler. O. W. Howard (1899) records such a nest and adds: "Other nests were placed in crevices along river banks where roots of trees were sticking out and one or two were found in natural cavities of the Giant Cactus, or in woodpecker holes therein." We found a nest with young in a cavity in the bleached skeleton of a fallen giant cactus, where I set up my camera and took several photographs of the bird feeding the young. A very pretty nest of this warbler is in the Thayer collection in Cambridge; it was evidently built in the fork of a mesquite limb, supported by a cluster of old and fresh, green twigs; it is made externally of the leaves, petioles, fine green twigs, and flower clusters of the mesquite and is decorated with a few feathers of the white-winged dove; it is lined internally with fine fibers, white cows' hair and black horsehair, and more dove feathers; it measures 4 by 3 inches in outside diameter and 2 by 1⅓ inside; the outside height is nearly 3 inches, and the inside cup is about 1¾ inches deep. A set in my collection was taken from a hole 3 feet above the base of a sandy bank along a wash near the San Pedro River, in Arizona.

Eggs.—Lucy's warbler lays from 3 to 7 eggs, but the set usually consists of 4 or 5; the larger sets are rare, but O. W. Howard has found two sets of 7, and several sets of 6 have been recorded. The eggs are ovate to short ovate and have very little lustre. The white or creamy white ground color is finely speckled with shades of "chestnut," "bay," or "auburn." The eggs that have markings in the darker shades of "chestnut" and "bay" frequently have a scattering of minute spots of "brownish drab" that are often lacking on eggs with the lighter markings of "auburn." The spots are usually concentrated at the large end. The measurements of 50 eggs average 14.6 by 11.4 millimeters; the eggs showing the four extremes measure 16.5 by 11.5, 14.6 by 12.0, 13.2 by 11.2, and 13.7 by 10.7 millimeters. (Harris.)

Young.—The period of incubation seems to be unknown, and I can find no information on the development and care of the young. Evidence points to the conclusion that incubation and brooding are performed entirely by the female, and that at least two broods are reared in a season. Mr. Swarth (1905) says that "several broods are probably raised, as unfinished nests and incomplete sets were found at the same time that broods of young as large as the adults were seen flying about."

Plumages.—Ridgway (1902) says that the young in juvenal plumage are "essentially like adults, but much clearer white beneath; no trace of chestnut on crown; upper tail-coverts ochraceous-buff instead of chestnut; middle and greater wing-coverts tipped with whitish or pale buffy, producing two rather distinct bars." He might have added that the tertials are edged with cinnamon, and that the primaries and rectrices are edged and tipped with white.

There is apparently a partial postjuvenal molt, some time during the summer, when all the plumage except the flight feathers, remiges, and rectrices, is renewed. Young birds now become very similar to adults, but can be recognized by the juvenal wings and tail until the edgings wear off. I can find no evidence of a prenuptial molt in either young or old birds. I have seen adults in complete postnuptial molt in August. Fall birds are tinged with brown above and with pale brownish buff below; the chestnut crown patch is concealed by very broad brownish gray tips. Females are not always distinguishable from males, but usually the chestnut on the crown and upper tail coverts is paler and more restricted.

Food.—Nothing definite seems to have been published on the food of Lucy's warbler, but it is evidently largely, if not wholly, insectivorous, as it is often seen foraging in the foliage and flower clusters of the mesquites and in other trees. Dr. W. P. Taylor tells me that he has seen it feeding on the pendant sprays of ocotillo flowers, probably gleaning insects or other materials from the exterior. In late spring when the mesquites, palo verdes, the various cacti, and even the saguaros burst into full bloom, these gorgeous desert plants are a blaze of color and attract myriads of insects.

Behavior.—Mr. Gilman (1909) says that "shyness about the nest seems to be characteristic of these birds." He was seldom able to flush one from its nest. "In three cases only, did the parent birds show what might be called proper amount of solicitude when the nest was approacht. Some of them seemed rather touchy about their nests, leaving them if the nest were toucht even so lightly." Some nests, with incomplete sets, were deserted after they had been inspected; but others were not. "They took good care not to sing in the nest tree, preferring to confine their performances to trees some distance away. The male would frequently meet me several rods from the nest and flit from tree to tree singing at short intervals. Once I made a complete circuit of the nest tree and he accompanied me the entire distance. This was an exceptional case of course. While going from tree to tree and singing, the bird usually tried to keep hidden as much as possible and was rather successful in the effort."

However nest-shy the bird may be when there are eggs in the nest that she does not want discovered, the bird that I watched was not at all shy about her nest, nor was she lacking in parental devotion. For, although my camera stood within a few feet of the nest and I was standing beside it in plain sight, she came repeatedly to feed her young. I should say that these birds are more retiring than shy.

W. L. Dawson (1923) writes: "Albeit an active creature and zealous in song, the Lucy Warbler becomes almost invisible in its habitual setting, and the difficulty of detection is heightened by the bird's instinctive wariness. Again and again I have known a bird which had seemed quite engrossed in song to fall silent at the stir of a footstep a hundred yards away."

Voice.—Mr. Dawson (1923) says: "The Lucy Warbler is a loud and industrious singer, but the song has a curious generic quality very difficult to describe. It is *Warbler* song, rather than the song of the Lucy Warbler. It is, perhaps, most like that of the Pileolated Warbler (*Wilsonia pileolata*) in quality. After that, it reminds one of the Yellow Warbler's song, having the same vivacious cadence, but not being so sharply piercing. Again its breathless, haphazard quality suggests one of the Buntings; and I once followed its tantalizing seductions for half an hour under the delusion that I was on the track of the coveted Beautiful Bunting (*Passerina versicolor pulchra*)."

Dr. Grinnell (1914) says that the song "resembles the song of the Sonora yellow warbler in length and frequency of utterance and somewhat in quality, but with a distinct hurried and lisping effect reminding one of the song of the Lazuli bunting." Several others have noted the resemblance to the song of the yellow warbler. Mrs. Florence Merriam Bailey (1923) puts the song in syllables as follows: "*whee-tee, whee-tee, whee-tee, whee-tee, whee-tee, whee-tee, whee-tee, whee-tee, whee-tee, wheet*, and its call was a faint *chip*."

Field marks.—There are no very striking marks on Lucy's warbler; it is clothed in quiet colors and in general appearance suggests a warbling vireo. The chestnut crown patch of the male can be seen under favorable conditions, but on the female it is seldom in evidence.

The chestnut upper tail coverts can be seen only when the bird is in certain positions. Its activity will mark it as a wood warbler, and it is the only one of this family likely to be found on its breeding grounds among the mesquites in the nesting season.

Enemies.—Mr. Howard (1899) says that "many nests are destroyed by wood-rats and snakes." And Mr. Dawson (1923) writes:

> Dwarf Cowbirds are prominent in the formidable host of enemies which this tiny bird must face. Sometimes the warblers are able to entrench themselves behind apertures so narrow that the Cowbird cannot get in; and once we saw the Cowbird's foundling resting unharmed, but also harmless, upon the "door-step," not less than two inches distant from the warbler's eggs. Another nest, more exposed, contained three eggs of the arch enemy, and had been deserted by the troubled owners. The Gila Woodpecker is an especially persistent enemy. Accustomed as he is to poking and prying, he seems to take a fiendish delight in discovering and devouring as many Lucy Warblers' eggs as possible. We caught several of these villains red-handed, and we found reason to believe that more than half of the nests in a certain section had been wrecked by them. Add to these the depredations of lizards, snakes, and, possibly, rats, and the wonder is that these tiny gray waifs are able to reproduce at all.

DISTRIBUTION

Range.—Southwestern United States to central Mexico.

Breeding range.—Lucy's warbler breeds **north** to southern Utah (Beaverdam Wash, Zion National Park; Calf Creek, Garfield County; and the San Juan River); and southwestern Colorado (Montezuma County near Four Corners). **East** to Colorado (near Four Corners); western New Mexico (Shiprock, possibly San Antonio, mouth of Mogollon Creek, and Redrock); southeastern Arizona (Bisbee); and northeastern Sonora (Moctezuma). **South** to northern Sonora (Moctezuma and Saric); southern Arizona (Baboquivari Mountains, Menager's Dam, and Gadsden); and southern California (Picacho and Silsbee). **West** to southern California (Silsbee, Mecca possibly, and Chemehuevis Valley); western Arizona (Fort Mojave); and southwestern Utah (Beaverdam Wash).

Winter range.—The few available records place the winter home of Lucy's warbler in central western Mexico from Jalisco (Bolaños and Lake Chapala) to eastern Guerrero (Iguala).

Migration.—Few migration dates are available for a species with such a limited range. Early dates of arrival are: Arizona—Tucson, March 12. California—Mecca, March 29. Utah—St. George, March 23. A late departure date is: Arizona—Tombstone, October 3.

Egg dates.—Arizona: 58 records, April 22 to June 27; 30 records, May 2 to 21, indicating the height of the season.

PARULA AMERICANA PUSILLA (Wilson)

NORTHERN PARULA WARBLER

Plates 20, 21

HABITS

I have always preferred the old name, blue yellow-backed warbler, as originally used by Wilson and Audubon, to the modern common name; it seems more descriptive of this dainty wood warbler. As to the origin of this newer name, Dr. Spencer Trotter (1909) writes: "The name 'parula' recently in vogue for the warblers of the genus *Compsothlypis* is clearly borrowed from the old Bonaparte genus *Parula* (diminutive of titmouse). The bird (*C. americana*) has appeared under various titles—'the Finch Creeper' of Catesby (I, 64), 'the various coloured little finch creeper' of Bartram (Travels, 292), and the 'Blue Yellow-backed Warbler' of Wilson, Audubon, and later authors." *Parula* was extensively used as the generic name during the last century, and is now reinstated to replace *Compsothlypis.*

The 1931 A. O. U. Check-List of North American Birds recognizes only two races of this species, the subject of this present sketch, *P. a. pusilla*, and the southern race, *P. a. americana.* The two forms together occupy a breeding range covering practically all of the United States east of the Great Plains, as well as parts of southern Canada, the type name being restricted to the birds breeding from the District of Columbia southward to Alabama and Florida.

Ridgway (1902) describes the northern bird as "similar to *C. a. americana*, but slightly larger, with smaller bill and darker, richer coloration; adult male with blue of upper parts deeper, and black of lores more intense; lower throat or upper chest (sometimes both) blackish or dusky (the feathers sometimes tipped with chestnut), forming a more or less distinct, often very conspicuous band; lower chest orange-tawny, tawny, or chestnut (the feathers usually margined with yellow) forming usually a distinct and often abruptly defined patch; sides usually more or less tinged or spotted with chestnut."

In the same work, he describes a third form, *C. a. ramalinae*, as "similar in coloration to" the northern bird, "but smaller even than *C. a. americana.*" He gives as its range the Mississippi Valley, from Mississippi, Louisiana, and Texas to Minnesota and Michigan. This western race is not recognized in the 1931 A. O. U. Check-List.

Our experience with the northern parula warbler in Bristol County, Mass., well illustrates the successive changes that nature and man have wrought in the distribution of so many of our birds. Many years ago, perhaps early in the last century or before, some hardy pioneers hewed out a clearing in the forest that clothed the slopes of Rocky Hill in Rehoboth, Mass., planted an apple orchard, and surrounded it with stone walls. All traces of the old farm, if ever there had been one, disappeared before I first visited the locality in 1888, and the forest had begun to encroach on the old clearing. The apple trees even then showed signs of old age and were profusely covered with long festoons of that picturesque tree lichen, often called beard-moss or old-man's-beard (*Usnea barbata*, *U. longissima*, or *U. trichodea*). This old orchard was a mecca for all local oologists, and many a set of eggs of the blue yellow-backed warbler was taken from it during succeeding years. As time passed, the old trees gradually died, the *Usnea* disappeared, the warblers ceased breeding there, and the forest eventually reclaimed the land until today only the ancient stone walls remain to mark the locally famous haunt of the blue yellow-backs.

I can remember several other old, neglected orchards that were similarly decorated with the long, gray-green lichen and that were inhabited by parula warblers as nesting sites, but they all suffered the same fate; the orchard trees decayed and were replaced by woods and thickets. During the early part of the present century this warbler continued to breed commonly in Bristol County wherever it could find trees infested with *Usnea*—around the edges of swamps and along the shores of ponds, lakes, and sluggish streams; but now this lichen seems for some reason to have entirely disappeared from the County, and the parula warbler has likewise disappeared, although it may still breed in a few similar localities on Cape Cod, Mass., where I have found it a few times in more recent years.

Localities such as those described above seem to be typical of the breeding haunts of the northern parula warbler, at least in New England, southern New York, and New Jersey. Whether the presence of *Usnea* is a sine qua non for the breeding haunts of this wood warbler is an open question; but it may safely be said that where this lichen grows in abundance one is almost sure to find it breeding; and conversely, where this lichen is scarce or lacking, the warbler breeds sparingly or not at all.

Farther westward, northward, and southward, where *Usnea* is scarce or entirely absent, these warblers seem to find congenial haunts in hemlock ravines and in other coniferous woods and swamps; but even there they are more likely to be found where there is at least *some* of one species or another of this lichen, or where the somewhat similar Spanish moss (*Tillandsia usneoides*) grows.

Spring.—Parula warblers that have wintered in the West Indies reach southern Florida during the first week in March. Dr. Wetmore (1916) says that it "was the most common of the migrant warblers in

Porto Rico. * * * Migratory movement was apparent among them by February 14, and after this the birds were very restless, especially during early morning, and there was tendency to work from the east to west. In March and April there were distinct waves of migration." But it is well on toward the middle of May before the first migrants reach the northern limits of their breeding range.

Professor Cooke's (1904) records show that the migrants from Mexico and Central America reach the Louisiana coast by the very last of February or early March, while the first arrivals on the lower Rio Grande, in Texas, come two or three weeks later. He observes:

> A comparison of the dates shows, first, that the parula warbler arrives in Texas much later than in either of the other States, and hence does not reach the Mississippi Valley by way of Texas; second, that it arrives in northern Florida at least ten days later than it attains the same latitude in Louisiana. From these two facts it would appear that Louisiana is reached by direct flight across the Gulf of Mexico. The average date of arrival at New Orleans coincides closely with the date when the first migrants arrive at the southern end of Florida. It would seem that the birds of Mexico and Cuba are prompted to move northward at the same time, but the flight over the Gulf of Mexico being so much longer than that from Cuba to Florida, the Mexican birds reach a higher latitude by their initial flight.

There are other interesting details in Cooke's account to which the reader is referred.

During migration the parula warbler does not frequent haunts typical of its breeding ground; in fact such are not to be found in much of the country over which it travels; nor does it especially frequent the coniferous woods to which it is partial in summer. It is to be found almost anywhere, in many kinds of trees, though it seems to show a decided preference for deciduous woods. There, it may often be seen drifting through the highest tree-tops in mixed groups of migrating wood warblers, gleaning insects amidst the freshly opening foliage. Referring to the Buckeye Lake region in Ohio, Milton B. Trautman (1940) writes: "The transient Parula Warblers usually displayed a preference for large pin oak and shingle oak trees and a marked preference for one shingle oak in particular. This oak was in the Lakeside Woods, and more Parula Warblers were observed in it than in all of the remaining trees of the woodland. A transient often displays a marked preference for certain types of trees, but it appears unusual for a single tree among many of the same kind to retain yearly so marked an attraction for a particular bird species."

The migrating parula warbler is often seen in roadside trees and in shade trees in parks and gardens. It even visits our orchards, where one of the most charming sights of springtime is to see this gay-colored, tiny warbler flitting about in search of insects among the apple blossoms, a delightful bit of color contrast in a beautiful setting.

Nesting.—The nests of the northern parula warbler that we used to find in southern Massachusetts were all located in haunts similar to those described, and mostly in old orchards heavily festooned with beard moss (*Usnea*). We could usually find three to five nests in a well-populated orchard, but they were so well hidden in the hanging moss that we may have overlooked some. A casual observer would never notice one, but with practice we learned to recognize a rounded, cuplike, thick place in a bunch of *Usnea* as indicating a nest. The nests were usually made in bunches of moss that hung from horizontal or sloping branches and were from 5 to 15 feet above the ground, more being below than above 12 feet. Some nests were in red cedars, or savins (*Juniperus virginiana*), scattered among other trees or growing in open stands by themselves; they were located in bunches of *Usnea* close to the center of the tree and often within reach from the ground. Occasionally, isolated trees on the edges of swamps or on the shores of ponds were sufficiently covered with the lichen to contain nests, and these were sometimes as much as 20 feet above the ground. The nearest approach to a colony that I ever found was in a small cedar swamp, not over an acre in extent, that jutted out from the shore of a lake into rather deep water.

The white cedars (*Chamaecyparis thuyoides*) were growing in water that was waist deep or more in places, and the whole place was so obstructed with fallen trees and sunken snags that it was very difficult to explore thoroughly; I managed to find some half a dozen nests, and there may have been others, for many of the trees were well "bearded."

The nests that we have found have all been very simple affairs, apparently merely pockets hollowed out in bunches of hanging *Usnea*, with side entrances slightly above the cups. Some nests were small and suspended only 2 or 3 inches below the supporting branch, practically open baskets accessible from directly above; others were found in long, thick bunches, a foot or more in length, with long streamers hanging below the nest. External measurements were therefore quite variable. Many of the nests were unlined, save with a soft bed of fine shreds of *Usnea;* some were scantily lined with a few pieces of fine grass, two or three pine needles, one or two horsehairs, or a few bits of buff-colored down from the stems of ferns; rarely, a nest was more elaborately lined with the latter material but never as profusely as are the nests of other wood warblers.

Apparently the nests were also difficult to find in Connecticut; "J. M. W." (C. L. Rawson, 1888), who has probably taken more eggs of the blue yellow-backed warbler than any other man, says that the older ornithologists did not realize "that the three Southern New England States were about the centre of its breeding range," until he began sending eggs to Dr. T. M. Brewer. Thomas Nuttall (1833) remarked: "The nest and eggs are yet unknown."

Rawson found the parula warbler nesting in colonies near Norwich, Conn., and says:

> I know a swamp where may be found seventy-five pairs of these summer residents. The first time I visited the Preston colony on the 31st of May, I took eight sets of four. The first time I visited another large community in this county on June 5, on a point of land trending into salt water, I took eleven sets of four. * * *
>
> The nests are built on dead or green trees, and on savins or deciduous trees, at varying heights. I took one from the single filament of moss caught on the green twig of a birch, within five inches of the ground, and others close to the trunks of great oaks fifty feet in the air. On the lower swamp, huckleberry brush in the littoral colony is a favorite site.

William Brewster (1906) mentions only one nest taken in the neighborhood of Cambridge, Mass., a region where *Usnea* is scarce:

> In shape and general plan of construction the nest closely resembles that of a Baltimore Oriole. It has no hole in the side but instead a wide-mouthed opening at the top through which the bird entered it as the Oriole enters her nest. The upper edges and sides were securely fastened to the fine terminal twigs of a drooping branch where the nest hung suspended among the evergreen foliage of the hemlock, precisely as the Oriole's hammock swings in the dropping spray of an elm. The Warbler's nest has a scanty lining of pine needles and fine grasses but it is otherwise composed entirely of *Usnea*, loosely woven or perhaps merely felted together, evidently by the parent birds. They must have been at some pains to collect this material, for the closest scrutiny on the part of a friend and myself failed to reveal more than a few small and scattered tufts of *Usnea* in the surrounding woods.

Henry Mousley (1924, 1926, and 1928), of Hatley, Quebec, made three attempts to make complete studies of the home life of the northern parula warbler, none of which covered the whole cycle for reasons beyond his control.

The nests were suspended from the branches of coniferous trees, at heights ranging from 26 feet in a spruce to 40 feet in a balsam fir. One of these nests was watched for a total of 24 hours, from May 22 to 31, during the process of construction; during this time the male sang 549 times from a little birch and went with the female to the nest, but brought no material; the female, however, made 206 trips with material, an average of one load every 5.4 minutes. The nest was made entirely of *Usnea*, all brought in, and lined with "some black hair-like rootlets, with two bits of plant down"; it was strengthened with a few fine grass stems. It weighed only 100 grains, or .23 ounce! "Outside diameter 3.25, inside 1.75 inches; outside depth 2.50, inside 1.75 inches. The female after selecting some of the longest threads of the hanging bunch of *Usnea*, attached them to a little twig a few inches off, following this up with that curious process—inherent—of mould-ing the nest, which in this case, was really an acrobatic performance, there being of course no apparent nest to mould, just a few strands, through which the bird's tail and wings protruded."

Outside New England, where *Usnea* is scarce, the nests are often built in hanging clusters of twigs of hemlocks or spruces, with the use of more or less of this lichen when available. In the lower Mississippi Valley, Spanish moss (*Tillandsia usneoides*) offers a popular substitute and is generally found growing in profusion. But some nests are built of various other materials. George H. Stuart, 3d, writes to me of a nest he found at Pocono Lake, Pa., on June 22, 1916: "This remarkable nest was placed in a horizontal limb of a spruce, 20 feet up and 12 feet from the trunk, near the tip and overhanging a road near the lake." It was "composed mainly of fine dry grasses and the thinnest of bark shreds, with a few bits of down, fashioned together oriole-like, though loosely, with a few coarse grasses projecting suggesting the handiwork of the magnolia warbler. The tiny basket was suspended from the under side of the branch, partially supported by inclining twigs. In form it is an inverted cone or pear, measuring 3 inches deep by 3 inches wide at the rim, the thin walls tapering down to a narrow, pointed bottom. The thinness of the walls in places revealed the eggs from a side view."

Mrs. Nice (1931) reports a curious nest, found by Mr. Kirn near Copan, Okla.; it was fastened to ivy leaves and to a stick which was hanging down, held by the vine. "In this hanging, swaying cluster about two feet long, the nest was built almost entirely of box elder blossoms held together by spider webs on the outside, and sycamore seed down on the inside with a light lining of fine strips of weed stems."

Several nests have been reported as built of various materials in bunches of leaves and other rubbish deposited by freshlets on branches over streams.

Because of the bird's habit of using various materials and sites in its nest building, it may be well to mention some nesting records from the southern Gulf States. Andrew Allison wrote to Dr. Chapman (1907):

> The invariable nesting site is a clump of Spanish moss—where this it to be had; I have not observed nests from beyond the range of this plant. The nest is generally placed near the branch from which the long filaments of the 'moss' depend, so that it is well concealed. The height from the ground varies from about eight feet upwards. * * * The nest is nearly hemispherical in shape, opening directly upward. The usual material, in lower Louisiana, is thistle down, which is abundant during the nesting season. Animal hairs are not used, I think. A nest from Bay St. Louis was composed of the very black horse-hair-like inner fiber resulting from the decay of *Tillandsia*.

M. G. Vaiden writes to me that he found a nest near Belzoni, Miss., in a heavy oak swamp where there were clusters of *Usnea* on practically all of the trees. The nest was 16 feet above the ground and 12 feet out on a limb of an oak; it was made like our northern nests and lined with the "moss" and fine rootlets. Another described in his notes was entirely different. It was in a section of Mississippi where there was no *Usnea* growing within 60 miles. The nest was 6 feet from the ground and 4 feet out in the crotch of a limb of a hackberry tree. A pretty nest, it was nicely constructed of leaves and bark from cypress trees, and was lined with small rootlets and very fine twigs.

Eggs.—The usual set for the northern parula warbler consists of 4 or 5 eggs; 3 sometimes constitute a full set, and as many as 6 or 7 have been found in a nest; there are 3 sets of 7 in the J. P. Norris collection. The eggs are ovate or short ovate, have only a slight gloss, and are white or creamy white, speckled and spotted with shades of "russet," "chestnut," "bay," and "auburn," with a few underlying spots of "brownish drab." There is much variation; on some eggs the "brownish drab" color is entirely lacking, while on others spots of this color are the most prominent markings; again, the eggs may be almost immaculate, or may have just a few indistinct freckles of "pale wood brown" at the large end. The measurements of 50 eggs average 16.5 by 12.1 millimeters; the eggs showing the four extremes measure **18.3** by 12.7, 16.9 by **12.9**, **14.8** by 11.9, and 16.3 by **11.2** millimeters (Harris).

Young.—The period of incubation does not seem to have been determined, nor do we know how long the young remain in the nest. Incubation of the eggs and brooding of the young is performed mainly by the female, but the male assists in both to some extent. I have seen a male leave a nest in which there were eggs; and Mr. Mousley (1924) saw a male brood the young for a period of 4 minutes in the absence of the female, but he left as soon as she returned. Both parents feed the young. Mr. Mousley's table shows that during a watching period of 15 hours the male fed the young 45 times and the female fed them only 21 times; the average rate of feeding was once in 13.6 minutes; during this time the male brooded once and the female 34 times, a total of 11 hours and 27 minutes. He "noticed that the food the male brought consisted almost invariably of soft green larvae, whereas, that of the female more often than not consisted of insects, and the portions she brought were usually smaller in proportion than those of her partner."

Plumages.—Dr. Dwight (1900) says that the natal down is "smoke-gray." The sexes are alike in the juvenal plumage, which Ridgway (1902) describes as "above plain slate-gray, slightly tinged with olive-green; middle and greater wing-coverts narrowly tipped with white; chin and upper throat pale yellowish; lower throat, chest, sides, and flanks plain light gray (intermediate between mouse gray and gray no. 6); abdomen, anal region, and under tail-coverts white; remiges and rectrices as in adults."

A postjuvenal molt, involving all the contour plumage and the wing coverts but not the rest of the wings or the tail, begins about the middle of July. This produces a first winter plumage in which old and young birds are very much alike and the sexes are recognizable. The young male differs little from the adult male, but the bluish gray of the upper parts is more heavily tinged with olive-green, the yellow of the under parts is duller, and the dark throat band is more or less obscured by yellowish tips on the feathers. The young female differs from the adult female in a similar way and is without any brown throat band.

Dr. Dwight (1900) says that the first nuptial plumage is "acquired by a partial prenuptial moult which involves chiefly the head, chin and throat, but not the rest of the body plumage, the wings nor the tail. The ashy blue crown feathers faintly dusky centrally, the blackish ones of the sides of the head with a white spot above and below the eye and the yellow or chestnut-tinged chin feathers as far as the pectoral band or farther are assumed by moult. Wear brings the back into contrast with the nape and whitens the lower parts. The wings and tail are browner and more worn than in the adult, especially the primary coverts."

A first postnuptial molt in July and early August, which is complete, produces the fully adult plumage. Fall males are similar to spring males, but the blue areas are more or less tipped with greenish and the throat bands with yellowish. Fall females differ in the same way from the spring birds, and there is little, if any, chestnut and no blackish in the throat band.

Subsequent molts and plumages are the same as described above for the young birds.

Charles C. Ayres, Jr., writes to me of a bird he observed near Ottumwa, Iowa: "It was a typical parula warbler with the exception that the blue-gray color extended over the throat and terminated abruptly on the upper breast. Immediately below the termination of the blue-gray color was the well-defined orange-brown breast band, below which the rest of the breast was yellow."

Food.—The parula warbler is almost wholly insectivorous. Its food is mainly obtained in the deciduous trees, where it is often seen among the branches and twigs or hanging downward under a cluster of leaves or blossoms like a chickadee searching for small insects, beetles, flies, moths, larvae, and egg clusters. Some flying insects are taken on the wing; and occasionally the bird may be seen feeding on the ground.

Dr. Wetmore (1916) reports on the contents of 61 stomachs from Porto Rico, which contained 97.7 percent animal matter and only 2.3 percent vegetable matter. The latter "consisted of seeds of small berries of the camacey (*Miconia prasina*) and others." In the animal food, beneficial insects and a large number of spiders amounted to about 35 percent, and the remainder were all harmful pests. "Lantern flies (Fulgoridae) (19.09 percent) were identified in 29 stomachs. * * * Other bugs (3.69 percent) comprise small numbers of leaf bugs, species of the chinch bug family, stinkbugs, and a few predaceous assassin bugs. The birds are fond of beetles, and this order supplies 22.53 percent of the food, nearly all being injurious species. Ladybird beetles (1.36 percent) were present in 14 stomachs. Longicorn beetles (1.68 percent) were taken 11 times, and leaf beetles of several species (7.95 percent) were eaten by 30 of these birds." Other beetles taken included darkling beetles, skin beetles, scarred-snout weevils, coffee leaf-weevils, stalk borers, and curculios. Among other items were a few ants and other small Hymenoptera (3.57 percent) and flies (1.19 percent). Caterpillars were found in 18 stomachs and moths in 4. Spiders (29.53 percent) were identified in 29 stomachs. Stuart T. Danforth (1925), from Puerto Rico, adds berries of *Varronia angustifolia* and fleabeetles, and says that large moth eggs were eaten by two birds, forming 25 percent of their food. Forbush (1929) says that "it feeds much on small hairless inch-worms, such as the fall canker-worm and the spring canker-worm, and on the younger and smaller hairy caterpillars, such as the gipsy and the tent caterpillar."

Behavior.—The parula warbler is less active in its movements, more sedate and deliberate, than most of the other treetop wood warblers. It creeps along the branches and hops from twig to twig, often clinging to the under side of a cluster like a chickadee, an action that led some of the early writers to refer to it as a small titmouse, and it sometimes clings to the trunk of a tree like a nuthatch in its search for food. The birds are fearless and confiding, and are easily approached. Even when their nest is disturbed they come within a few feet of the intruder, making little, if any, protest or demonstration. George B. Sennett (1878) tells the following story, illustrating the confiding nature of the bird:

> Just before we sighted land, imagine our surprise and joy to see a little Blue Yellow-backed Warbler on our mast. It soon flew down to the sail and thence to the deck, where, after a few moments, it felt quite at home. Our sailor caught him, and he was passed around for all to admire and pet. It would nestle in our hands and enjoy the warmth without the least fear. When

allowed his freedom, he would hop upon us, fly from one to another, and dart off over the side of the boat as if taking his departure; when lo! back he would come with a fly or moth he had seen over the water and had captured. Several flies were caught in this way. He searched over the whole boat and into the hold for insects. Often he would fly to one or the other of us, as we were lying on the deck, and into our hands and faces, with the utmost familiarity. He received our undivided attention, but could have been no happier than we. Upon reaching shore, amid the confusion of landing we lost sight forever of our pretty friend."

Voice.—The parula warbler has a simple, but to my ears a very distinctive, song. In 1900 I recorded the song in my notes as "*pree-e-e-e-e-e-e*, *yip*, a somewhat prolonged trill like a pine warbler's, but fainter and more insect-like, ending abruptly in the short *yip* with a decided emphasis." I have always been able to recognize it by the explosive ending, which I never heard from any other wood warbler.

Gerald Thayer wrote to Dr. Chapman (1907) as follows:

> The Parula is weak-voiced, and its call notes, as far as I know, are slight and barely peculiar; but it has at least three main songs, with great range of variations.
>
> All may be recognized, or at least distinguished from the weak songs of the *Dendroicae*, like the Blackburnian and Bay-breast, by their beady, buzzy tones. In phrasing, in everything but tone-quality, certain variations of the Parula's and of the Blackburnian's songs very nearly meet and overlap; but the tell-tale tones remain unchanged,—wheezy and beady in the one, smooth as glass in the other. Commonest of the Northern Parula's three main songs is probably the short, unbroken buzz, uttered on an evenly-ascending scale, and ending abruptly, with a slight accentuation of the final note. Next is that which begins with several notes of the same beady character, but clearly separated, and finishes, likewise on an ascending scale, with a brief congested buzz. The third main song is based on an inversion of the second—a buzz followed by a few separate drawled notes, high-pitched like the buzz-ending of the two other songs. All these vary and intervary perplexingly.

Aretas A. Saunders contributes the following notes on the song of this warbler: "The parula warbler has two distinct types of song. One is a simple buzzy trill rising in pitch, and frequently terminated by a short, sharp note of lower pitch. Of 12 records of this song, 7 have the terminal note and 5 do not. The other form has the same buzz-like quality, but begins with three or four short notes on the same pitch, followed by a longer, higher note that is frequently, but not always, slurred upward. Both songs are similar in length and in pitch intervals. They vary from $1\frac{1}{5}$ to $1\frac{3}{5}$ seconds in length. The rise in pitch varies from one to four and a half tones, and averages about two tones. The actual pitch is exceedingly variable in individuals and varies from A''' to D''''. Songs vary considerably in loudness, many of them becoming suddenly louder toward the end.

"The species sings throughout migration, and on the breeding grounds till late July. At that season I have seen males still singing while feeding young just out of the nest."

Enemies.—Dr. Friedmann (1929) writes; "This bird is practically free from that greatest enemy of most of the warblers, the Cowbird. Occasionally, however, parasitic eggs are found in the dainty pensile nests of the Parula Warbler. Stone found a nest on May 26, 1892, at Cape May Point, New Jersey, containing three eggs of the Warbler and one of the Cowbird. * * * Five other records have come to my notice, from Long Island, New York, Pennsylvania and Connecticut, and the bird is listed as a victim of the Cowbird by several writers, as Bendire, Davie, and Chapman." Mrs. Nice (1931) records two more cases in Oklahoma.

Harold S. Peters (1936) records two lice, *Myrsidea incerta* (Kellogg) and *Ricinius* sp., as external parasites on this species.

Field marks.—The parula is one of our smallest warblers. The adult male is well marked, with its blue upper parts, the yellow back being inconspicuous, two conspicuous white wing bands, black lores, yellow breast and chestnut or blackish throat band. The female is duller in all colors, more greenish above and has little or no throat band. Young birds are even less conspicuously marked, as noted in the description of plumages.

Fall.—As soon as the young are strong on the wing the family parties desert their breeding grounds, and after the molting season is finished they resort to the deciduous woods and join the migrating hosts of warblers and other small birds drifting southward through the treetops or along the roadside shade trees. The fall migration is apparently a reversal of the springtime routes, as they travel to their winter haunts in Mexico and the West Indies. Professor Cooke (1904) says that this warbler "passes through Florida in countless thousands, being second only to the black-throated blue warbler in the frequency with which it strikes the lighthouses. * * * By the middle of September the great flights begin and continue in full force for a month."

DISTRIBUTION

Range.—Southern Canada to Nicaragua and the West Indies.

Breeding range.—The Parula warbler breeds **north** to southern Manitoba (Shoal Lake and Caddy Lake); central Ontario (Off Lake, Rossport, and Lake Abitibi); and southern Quebec (Lake Timiskaming, Blue Sea Lake, Gaspé Peninsula, and Anticosti Island). **East** to Anticosti Island (Fox Bay); Prince Edward Island (Tignish); Nova Scotia (Halifax and Yarmouth); and the Atlantic coast south to central Florida (Deer Park, Lake Gentry, and St. Lucie). **South** to central Florida (St. Lucie, Bull Creek Swamp, and Tarpon Springs) and the Gulf coast to south-central Texas (Houston and San Antonio). **West** to central Texas (San Antonio and Kerrville); eastern Oklahoma (Caddo, Red Oak, and Copan); eastern Kansas

(Neosha Falls, Topeka, and Leavenworth); central Iowa (Des Moines); north-central Minnesota (Cass Lake and Itasca); and southeastern Manitoba (Shoal Lake).

Winter range.—The parula warbler winters **north** to southern Tamaulipas (Tampico); occasionally southern Florida (Tarpon Springs, Sanibel Island, and Miami); the Bahamas Islands (Nassau and Caicos); Hispaniola (Tortue Island and Samaná); Puerto Rico; the Virgin Islands (St. Thomas); and the Lesser Antilles (Saba). **East** to the Lesser Antilles (Saba, St. Christopher, Guadaloupe, and Barbados). **South** to the Lesser Antilles (Barbados); Jamaica (Kingston); and Nicaragua (Río Escondido). **West** to Nicaragua (Río Escondido); El Salvador (Barra de Santiago); western Guatemala (San José and Escuintla); southern Oaxaca (Tehuantepec); Veracruz (Tlacotalpan); and Tamaulipas (Tampico).

The above range is for the species as a whole, of which two geographic races are recognized: the southern parula warbler (*P. a. americana*) breeds in southeastern United States from Maryland southward, east of the mountains; the northern parula warbler (*P. a. pusilla*) breeds in the western and northern portion of the range.

Migration.—Late dates of spring departure from the winter home are: El Salvador—Barra de Santiago, April 18. Guatemala—San José, March 7. Yucatán—San Felipe, April 4. Virgin Islands—St. Croix, April 30. Puerto Rico—Mayagüez, May 7. Haiti—Port au Prince, April 4. Cuba—Habana, May 4. Bahamas—Cay Lobos, May 14.

Early dates of spring arrival are: Florida—Daytona Beach, March 3. Alabama—Coosada, March 25. Georgia—Savannah, March 8. South Carolina—Frogmore, March 5. North Carolina—Washington, March 26. West Virginia—Bluefield, April 9. District of Columbia—Washington, April 6. Pennsylvania—Carlisle, April 25. New York—Shelter Island, April 23. Massachusetts—Stoughton, April 25. Vermont—St. Johnsbury, April 21. Maine—Portland, April 29. Nova Scotia—Wolfville, May 8. New Brunswick—St. Stephen, May 9. Quebec—Quebec, May 10. Louisiana—New Orleans, February 15. Mississippi—Bay St. Louis, March 5. Arkansas—Helena, March 24. Tennessee—Athens, April 3. Kentucky—Eubank, April 4. Indiana—Bloomington, April 21. Ohio—Columbus, April 28. Michigan—Ann Arbor, April 29. Ontario—Toronto, May 2. Missouri—Columbia, April 5. Iowa—Grinnell, April 28. Wisconsin—Madison, April 30. Minnesota—Red Wing, May 5. Texas—Hidalgo, March 5. Oklahoma—Caddo, March 25. Kansas—Independence, April 8. Nebraska—Havelock, April 20.

Late dates of fall departure are: Minnesota—St. Paul, October 5. Wisconsin—Milwaukee, October 9. Missouri—St. Louis, October 5.

Ontario—Point Pelee, October 5. Michigan—Grand Rapids, October 19. Ohio—Toledo, October 19. Indiana—Richmond, October 14. Tennessee—Nashville, October 3. Arkansas—Monticello, October 2. Louisiana—Covington, October 26. Mississippi—Gulfport, November 2. Quebec—Hatley, September 30. New Brunswick—Scotch Lake, September 28. Maine—Portland, October 24. New Hampshire—Hanover, October 11. Massachusetts—Rockport, October 25. New York—Rhinebeck, October 21. Pennsylvania—Berwyn, October 26. District of Columbia, Washington, October 17. West Virginia—French Creek, October 1. Virginia—Lynchburg, October 17. North Carolina—Rocky Mount, October 23. South Carolina—Charleston, October 22. Georgia—Athens, November 4. Florida—Gainesville, November 19.

Early dates of fall arrival are: Bahamas—Watling Island, September 28. Cuba—Habana, August 10. Dominican Republic—San Juan, October 21. Puerto Rico—Parguera, September 19. Nicaragua—Río Escondido, October 20. Costa Rica—Villa Quesada, October 24.

Banding.—Only a single migration record is available from banded birds. A parula warbler banded as an adult at Flushing, Long Island, New York, on September 16, 1946, was found dead about October 1, 1947, at La Grange, Maine.

Casual records.—The parula warbler has been recorded three times in Colorado (in El Paso County, at Kit Carson, and at Denver); and three times in Wyoming (once at Cheyenne and twice at Torrington).

Egg dates.—Massachusetts: 52 records, May 20 to July 7; 29 records, May 29 to June 10, indicating the height of the season.

Connecticut: 39 records, May 25 to June 25; 25 records, June 1 to 10.

South Carolina: 20 records, April 10 to June 24; 10 records, April 30 to May 11.

PARULA AMERICANA AMERICANA (Linnaeus)

SOUTHERN PARULA WARBLER

Plate 22

HABITS

This southern race of our well-known blue yellow-backed warbler is said to breed from the District of Columbia southward to Florida and Alabama. William Brewster (1896), in describing and naming the northern race, restricted the Linnaean name *americana* to the southern bird because it was evidently based on Catesby's excellent plate, drawn from a bird taken in South Carolina. In his comparative diagnoses of the two forms, he describes the southern bird as "averaging slightly smaller but with longer bill. Adult male with more yellow on the under parts and less black or blackish on the lores and malar region; the dark collar across the jugulum narrow, obscure, often nearly wanting; the chest pale, diffuse russet, without obvious markings." He admits that no one of these characters is quite constant, the best one being the depth and definition of the reddish brown on the chest. And he suggests that the distribution of the two forms in the breeding season may be roughly correlated with the distribution of *Usnea* in the north and of *Tillandsia* in the south, in which the two forms, respectively, seem to prefer to build their nests. This, however, is not strictly accurate or universal (for example, see some remarks by M. G. Vaiden, under the preceding form, on the breeding of this species in two different localities in Mississippi).

Arthur T. Wayne (1910) says of the haunts of the southern bird in South Carolina: "As soon as the sweet gum trees begin to bud, the song of this beautiful bird is heard. It heralds the approach of spring and is one of the first warblers to arrive which does not winter. The range of this species in the breeding season is entirely governed by the presence or absence of the Spanish moss, and where the moss is growing in profusion the birds are common, but where the moss is absent the birds are absolutely not to be found."

A. H. Howell (1932) calls this southern subspecies "an abundant spring and fall migrant [in Florida]; a common summer resident south at least to Osceola County; and a rare winter resident, chiefly in the central and southern part. Owing to the presence of a few wintering individuals, it is difficult to determine when spring migration begins. * * * Positive evidence of migration is furnished by the appearance of large numbers striking the light on Sombrero Key, March 3, 1889, when 250 birds were observed and 30 were killed. This species is one of the most numerous and regular visitants at the lighthouses on the east coast and on the Keys." Many of these were, of course, the northern race. Of the haunts of the southern race, he says: "The dainty little Parula Warbler is found most frequently in cypress swamps or heavily timbered bottomlands, and to a lesser extent in the upland hammocks. The abundant Spanish moss on the trees furnishes ideal nesting sites for the birds."

Nesting. Except for the fact that the so-called Spanish moss (*Tillandsia*) replaces the beard moss (*Usnea*), the nesting habits of the two races are very much alike. A. T. Wayne (1910) says that in South Carolina "the nest is always built in the festoons of the Spanish moss, from eight to more than one hundred feet from the ground, and is constructed of the flower of the moss and a few pieces of fine, dry grass." The nesting habits in Florida are very similar.

In southeastern Virginia, according to Harold H. Bailey (1913) this southern race is:—

> a most common breeding bird in its favorite haunts, the cypress or juniper swamps of the southeastern section; Cape Henry southward. These trees seem to furnish particularly fine feeding grounds, and wherever you find one festooned with the long, hanging Spanish moss, here also you are likely to find one or more nests. In this section I should call them a colony bird, for in days past I have seen on the trees in and surrounding one small lake, as many as two hundred pair breeding in company. The Dismal Swamp and its surrounding low territory has been an ideal spot for a feeding and breeding home in years past, but of late, the cutting of the juniper for commercial purposes, and the disappearance of the moss to a great extent, has driven the majority of the birds elsewhere.

Eggs.—These are indistinguishable from those of the northern parula warbler. The measurements of 50 eggs average 16.2 by 12.0 millimeters; the eggs showing the four extremes measure **19.5** by **12.7** and **14.0** by **11.0** millimeters (Harris).

Food.—Howell (1932) reports: "Examination of the stomachs of four birds taken in Florida in February showed the contents to consist almost wholly of insects and spiders, with a few bud scales. Hymenoptera (ants, bees and wasps) composed the largest item, amounting in two instances to approximately half the total contents. Other insects taken in smaller quantities were lepidopterous larvae, fly larvae, beetles, weevils, scale insects, bugs, and grouse locusts. Spiders were found in three stomachs, and amounted to about 20 per cent of the total food."

PACULA PITIAYUMI NIGRILORA (Coues)

SENNETT'S OLIVE-BACKED WARBLER

HABITS

This northern race of a wide-ranging species is represented by a number of allied races in Central and South America. From its range in northeastern Mexico it rarely crosses our border into the valley of the lower Rio Grande in southeastern Texas. For its introduction into our fauna and for most of our knowledge of its habits we are indebted to George B. Sennett (1878 and 1879) and to Dr. James C. Merrill (1878). The discovery of the bird in Texas in 1877 is thus described by Mr. Sennett:

> On April 20th, soon after reaching Hidalgo, I was directed up the river some four miles by road, and there shot the first three specimens of this new species. On May 3d, another was shot among the mesquite timber of the old resaca, within a mile of town.
>
> On May 8th, another was shot in a dense forest about half a mile from where the first three were obtained. Several more were seen; in fact, they were more abundant than any other Warbler. * * * All of the specimens

> obtained are males, and I remember of seeing none in pairs. They were seen usually in little groups of three or four. They are by no means shy, but frequenting, as they do, the woods, cannot be readily seen.

He visited the locality again the following year and says in his report (1879):

> It is truly a bird of the forest, and delights to be in the upper branches of the tallest trees. The song of the male is almost continuous as it flies about, and is so clear that it can be heard at a long distance and readily distinguished from all other birds. By its notes we could locate the bird, and this accounts for our securing so many more males than females. Were it not for its song, I doubt if we would have taken many, owing to their diminutive size and habit of frequenting the tops of the forest-trees. As it was, by only taking such as came in our way, we shot over twenty specimens, and could have taken any number more had we set out for them alone. In feeding habits I could see nothing different from our familiar Blue Yellow-back, *P. americana.*

Dr. Merrill (1878) says of its haunts: "Arrives about the third week in March, and passes the summer among thick woods and near the edges of lagoons where there is Spanish moss." We found Sennett's warbler fairly common around Brownsville, especially on the edges of the resacas, partially dry old river beds where the trees, mostly small mesquites, are more or less draped with *Usnea* and suggest the places where we would look for parula warblers in the north.

In appearance and behavior they were strikingly reminiscent of our northern friends. Sutton and Pettingill (1942) found this warbler up to 2,000 feet elevation in southwestern Tamaulipas, in full song on March 14, and a pair copulating on March 20.

Nesting.—Dr. Merrill sent to Mr. Sennett (1878) the following description of a nest he found near Brownsville after Mr. Sennett left: "My nest of *Parula* was taken July 5th, about five miles from here. It was placed in a small thin bunch of hanging moss, about ten feet from the ground, in a thicket; was simply hollowed out of the moss, of which it was entirely composed, with the exception of three or four horsehairs; entrance on side; contained three young about half fledged. Parents very bold, but thinking they were *americana* I did not shoot them."

The next year, his Mexican guide brought him a nest and a broken egg, which Mr. Sennett (1879) describes as follows:

> The nest is exceedingly interesting and beautiful. It is made in a gray mistletoe-like orchid, an air-plant very common on the Rio Grande, which establishes itself on the small branches of trees, and varies in size up to eight or ten inches in diameter. This one is six inches long by four and one-half inches wide, quite firm in texture, and was fastened some ten feet from the ground, to the end of a drooping branch of a brazil-tree in open woodland. The nest is constructed very simply, being formed by parting the gray leaves of the orchid and digging into its centre from the side, a cavity some two inches in diameter being made, with an opening of one and one-quarter inches. The bottom and sides are lined pretty well up with short cotton wood fibres, forming a fine matting for

> the eggs to rest upon. A firmer and more secure nest is seldom seen, although so easily made. I imagine a day would complete one, and certainly but little time need be wasted in selecting a site, for thousands of orchids stand out on the partially dead branches on trees with little foliage. That they build also in the hanging trusses of Spanish moss, so abundant everywhere, is true, the young before referred to being found in a nest in one.

There are two nests of Sennett's warbler in the Thayer collection in Cambridge. One of these was taken for F. B. Armstrong in Tamaulipas, Mexico, on July 5, 1911, and held three eggs. It is described as a "nest of hair in bunch of growing moss hanging from limb of cypress tree in river bottom," 8 feet up; it is built right into the *Tillandsia* and is made almost wholly of black and white cattle hair. The other, with a set of four eggs, was taken by James Johnson near Saltillo, Mexico, on May 27, 1906. It is described by the collector as "dug and hollowed in a bunch of pipestem mosses." It is a compact little nest made of very fine rootlets, very fine grasses, shreds of the brown inner bark of the palmetto or palm, and some weed blossoms; it is lined with finer shreds, a little plant down, and a few feathers. Externally it measures 2½ inches in diameter and 2 inches in height; the inside diameter is about 1½ inches; and the depth of the cup about 1¼ inches.

Eggs.—Either 3 or 4 eggs seem to constitute the full set, as far as we now know, for Sennett's warbler. The 7 eggs in the Thayer collection vary from ovate to short ovate, and have only a slight lustre. They are white or creamy white and are speckled and spotted with shades of "wood brown," "cinnamon-brown," or "Brussels brown," with underlying spots of "pale brownish drab." On some eggs the markings run to much darker browns, such as "auburn" and "chestnut," and on these the drab spottings are frequently lacking. Usually a loose wreath is formed where the spots are concentrated at the large end, but occasionally they are distributed nearly evenly over the entire surface. The measurements of 36 eggs average 16.3 by 12.2 millimeters; the eggs showing the four extremes measure **19.0** by **13.7** and **15.0** by **11.3** millimeters (Harris).

Plumages.—Young Sennett's warblers that I have examined are uniform grayish olive above, inclining to olive-green on the back; the black lores and cheeks are lacking; the median wing coverts are narrowly tipped with whitish, and the greater coverts more broadly so; the chin is pale yellow; the chest and upper breast are shaded with pale gray and centrally tinged yellowish; the abdomen is dull white; and the sides and flanks are shaded with pale olive-grayish. I have not seen enough material to trace subsequent molts and plumages, which doubtless parallel those of the parula warbler.

Food.—We have no definite information about the food of Sennett's warbler, but Clarence F. Smith has sent me the following note:

"The only laboratory report available on the food of the species pertains specifically to a South American subspecies of the *pitiayumi* group. The stomach contents were reported to consist of remains of hymenopterous insects and two-winged flies (Zotta, 1932)."

* * *

Nothing further seems to have appeared in print regarding the habits of this warbler. It is much like the well-known parula warbler in appearance and behavior, but can be recognized in the field by the conspicuous black lores and cheeks and by the complete absence of any pectoral band.

DISTRIBUTION

Range.—The species ranges from southern Texas to northern Argentina and Uruguay. The race occurring in the United States is found in southern Texas and northeastern Mexico.

Breeding range.—Sennett's olive-backed warbler breeds **north** to northeastern Coahuila (Sabinas); and southern Texas (Hidalgo, Harlingen, and Point Isabel). **East** to southern Texas (Point Isabel and Brownsville); and southeastern Tamaulipas (Altamira and Tampico). **South** to southern Tamaulipas (Tampico); and southern San Luis Potosí (Valles). **West** to eastern San Luis Potosí (Valles); and eastern Coahuila (Cerro de la Silla and Sabinas).

Winter range.—While probably not a sedentary form, its winter range very nearly coincides with its breeding range. It has been found in winter from Brownsville, Tex., to northern Hidalgo (Jacala).

Egg dates.—Texas: 6 records, April 28 to May 30; 4 records, May 2 to 12, indicating the height of the season.

Mexico: 2 records, May 27 and July 5.

PARULA GRAYSONI Ridgway

SOCORRO WARBLER

HABITS

The Socorro warbler is closely related to Sennett's warbler and other races of *pitiayumi* but is accepted as a distinct species. It differs from *nigrilora* in having gray, instead of black, lores and cheeks, and in having much less white on the inner webs of the outer rectrices. It was supposed to be confined to Socorro Island, one of the Revillagigedo group, about 250 miles southwest of the southern tip of Baja California. It was added to our fauna by Chester C. Lamb (1925), who states:

> On November 3, 1923, I collected one of these birds at Todos Santos, on the Pacific Ocean side of the peninsula of Lower California, some forty miles north

of Cape San Lucas. * * * On February 5, 1924, I saw another of these little warblers, within a few feet of me; but my gun was not at hand, so I had to be content with a sight record. The locality was inland, at El Oro, on the east side of the Victoria Mountains, about thirty miles from Todos Santos. The next occurrence, like the first, was at Todos Santos, where, on July 23, 1924, I secured an adult female which is now in my collection at the Los Angeles County Museum, Los Angeles. The taking of these two birds, in the winter and summer of two successive years, would indicate that the species is of more or less regular occurrence in the Cape Region of Lower California. The capture of a specimen in July suggests the possibility of breeding at the point of record.

Nothing more seems to have been heard of the species since. And we know nothing of its habits.

DISTRIBUTION

Range.—Socorro Island and the Cape region of Baja California.

Breeding range.—The Socorro warbler is known to breed only on Socorro Island, where it is resident. It has been found in the breeding season near Todos Santos, Baja California.

This warbler has been found in winter in two localities (Todos Santos and El Oro) in Baja California, and appears to be resident in small numbers.

PEUCEDRAMUS TAENIATUS ARIZONAE Miller and Griscom

NORTHERN OLIVE WARBLER

PLATE 23

HABITS

The olive warbler was long classed as a species of *Dendroica*, with *Peucedramus* regarded as a subgenus, but it is now properly placed in a genus by itself, for as Dr. Chapman (1907) points out it differs from *Dendroica* chiefly "in its slenderer, more rounded bill, proportionately longer wings (about 1.00 inch longer than the tail) and decidedly forked tail, the central tail feathers being more than .25 inches shorter than the other ones. In general color and pattern of coloration *Peucedramus* is markedly unlike *Dendroica*, from all the species of which the male differs in requiring two years to acquire adult plumage."

For a still longer time it was supposed to be a homogeneous species, until Miller and Griscom (1925) made a study of it and divided the species into five subspecies, mostly Mexican and Central American. In giving this bird the name *P. t. arizonae*, they state that it is entirely different in coloration from the type race; "upperparts plain mouse-gray, in spring plumage almost never tinged with olivaceous, even on the upper tail-coverts, appearing lighter and grayer than typical *olivaceus;* collar on hind neck not so complete, usually invading the occiput; primaries rarely if ever edged with olive-green in spring plumage; head and throat plain ochraceous, duller than in typical *olivaceus;* underparts lighter, the center of the belly purer white, more contrasted with the flanks, which are less olivaceous, more grayish brown; size as in typical *olivaceus.* Throat and side of neck of adult female and immature pale lemon-yellow." They give as its range "mountains of southern and central Arizona south at least to Chihuahua and perhaps east to western Tamaulipas (Miquihuana)."

The species had long been known in Mexico and had been erroneously reported in Texas, but it remained for Henry W. Henshaw (1875) to record it definitely as a North American bird by capturing three specimens on Mount Graham, Ariz., in September, 1874. Since then it has been noted by numerous observers on several other mountain ranges in southern Arizona, where it is now known to be fairly common in summer and where a few remain in winter.

It is a bird of the open pine forests on or near the summits of the mountains. In the Huachucas we found it breeding at about 9,000 feet elevation in the open forests of yellow pine, sugar pine, and fir. As Swarth (1904) says: "I found them only in the pine forests of the highest parts of the mountains, even in cold weather none being seen below 8,500 feet; and more were secured above 9,000 feet than below it."

In the Chiricahuas, Frank Stephens collected a fine series of these warblers for William Brewster (1882a) in March, 1880, in the pine woods at elevations from 10,000 to 12,000 feet. And it was here that W. W. Price (1895) found the first nest in 1894; "the region was a dry open park, thinly set with young pine (*Pinus jeffreyi*), at between nine and ten thousand feet above the sea."

The olive warbler is not always confined to the pines at all seasons, for Dr. Walter P. Taylor tells me that he obtained a single specimen from an oak tree in the Santa Rita Mountains at 5,000 feet on February 4, 1923. It was in the same general locality with bridled titmice and ruby-crowned kinglets, and was alone, perhaps a winter wanderer, foraging nervously through the foliage of the oak.

Spring.—According to Swarth (1904), migrating olive warblers reach the Huachuca Mountains, from their winter resorts in northern Mexico, about the first of April. "In 1903 they became fairly abundant, particularly in April, when many small flocks of five or six birds each, were seen. * * * They were seldom in company with other warblers, but when not alone, associated with nuthatches and creepers." Frank C. Willard (1910) says that "the first few days are spent, as it were, in staking out their claims anew. The males at this time are quite pugnacious toward one another, and, tho apparently already mated, they promptly drive any wanderer of the same sex from their selected bit of forest. I believe they return each year to the same locality in which they made their home of the previous year, as I have found them in the same patch of trees year after year while other places near by, with the same apparent advantages, never seem to be chosen." Dr. Taylor (MS.) saw a pair of olive warblers, 20 to 30 feet up in some yellow pines in the Santa Catalina Mountains on May 13, 1928. They kept giving a whistled call with descending inflection. "The two birds were courting apparently, flying about, often facing each other at short range, 6 to 18 inches, calling at very frequent intervals."

Nesting.—To William W. Price (1895) belongs the honor of finding the first nest of the Arizona olive warbler. On June 15, 1894, on the Chiricahua Mountains, he—

> saw a female, closely followed by a male, fly from a bush of spirea (*Spirea discolor*) to the top of a small pine, and busy itself on a small horizontal limb partially concealed by pine needles. She soon returned to the spirea, followed by the male, which did not enter the bush but perched on a pine branch near by. The female again flew with a dry flower-stem in her bill, from the bush directly to the pine, where a nest was in process of construction. * * * A few days after, a forest fire drove me from my camp, and it was not until July 1 that I was able to visit the nest. The female was sitting, and when frightened from the nest, kept hovering about, but made no sound. The male did not appear at all. The nest was compactly built and placed on a small horizontal branch, about forty feet from the ground, and about six feet from the top of the tree. The eggs, four in number, were in an advanced state of incubation. * * * The body and walls of the nest are composed of rootlets and flower stalks of *Spirea discolor*, and the inner lining consists of fine rootlets and a very small quantity of vegetable down. It is a compactly built structure, measuring about 4 inches in outer diameter by 1¾ inches in depth; the inner cup measures 2 inches in width by 1⅛ inches in depth.

A few years later, O. W. Howard (1899) reported finding four nests in the Huachuca Mountains; one was about 30 feet up in the fork of a large limb of a red fir; another was in a sugar pine near the extremity of a limb and about 30 feet from the ground; a third was near the end of a long slender limb of a yellow pine, about 50 feet up, and well concealed among the long pine needles; the fourth was on a branch of a red fir, not far from the trunk, and over 60 feet from the ground.

F. C. Willard (1910), collecting in the Huachucas, says that "short-leaf pines, long-leaf pines and firs are chosen for the nesting sites." One female that he watched building her nest "was gathering rootlets at the time and seemed very particular about them, picking up and dropping several before selecting one which she thought satisfactory. This she carried into a dense growth at the tip of a branch of a large fir about one hundred yards away. The male was singing and feeding in a tree close by. After a few trips with material the female would fly into the tree where he was and let him feed her. This is the only time I have observed nest building going on and the male not following the female in her flights." In his description of the nest, he says: "It is supported by ten small live twigs from the size of a pencil down, all growing from a branch about five eighths of an inch in diameter. It is composed outwardly of moss and pine bud hulls with plant down scattered thruout. The proportion of this latter increases until the the lining is reacht where it forms a felt like a hummingbird's nest. This lining is supplemented with a few very fine rootlets."

He gives an interesting account of his attempts to locate another nest in "a short-leaf pine whose branches were weighted down with masses of twigs and cones." He worked from ten in the morning until three in the afternoon, following the birds about, climbing the suspected tree several times and cutting off many twigs, before he finally found the nest. "The tree was not a very large one and I had shaken every branch and jarred them with my foot, but until I practically toucht the nest she had stayed on."

While I was in Arizona with Willard he collected for me on May 30 a beautiful nest of the olive warbler, with four fresh eggs. It was taken at an altitude of 8,500 feet on the Huachuca Mountains and was built in a clump of mistletoe near the tip of a branch of a sugar pine about 20 feet out from the trunk and 55 feet from the ground. Its construction was similar to those described previously (pl. 23). The loftiest nest that he ever found was 70 feet from the ground in a pine.

The nest built by the Arizona olive warbler is beautiful, and quite different from that of any other species of its group. A typical nest (in the Thayer collection in Cambridge) is made mainly of a brown lichen or moss mixed with other lichens and mosses, bud scales, flower scales, and some plant down, reinforced with fine yellowish rootlets. All these are compactly worked into and supported by the living needles of the yellow pine in which the nest was built. The lining consists of plant down and finer strands of the same yellowish rootlets. It measures 3½ by 3 inches in outside diameter and 2½ in height; the inner cavity is about 2 inches in diameter and 1¼ inches in depth.

Eggs.—Three or four distinctive eggs seem to constitute the full set for the northern olive warbler. These are ovate to short ovate and have a very slight lustre. They are grayish or bluish white, or even very pale blue, liberally speckled, spotted and blotched with "dark olive-gray," "dark grayish olive," "drab," "olive-brown," or "dark brownish drab." These are interspersed with undertones of "mouse gray," "deep mouse gray," or "Quaker drab." On some eggs the spots are sharp and distinct, while on others the olive, brown, and drab markings are clouded into the undertones. The spottings are usually well scattered over the entire surface, but tend to become heavier at the large end. The measurements of 28 eggs average 17.1 by 12.8 millimeters; the eggs showing the four extremes measure **19.0** by **16.0, 16.0** by 12.2, and 18.1 by **12.0** millimeters (Harris).

Young.—Information is lacking on incubation and care of the young.

Plumages.—The plumages and molts of the olive warbler are as distinctive as its nest and eggs. The sexes are not quite alike in juvenal plumage. Ridgway (1902) describes the young male as "pileum, hindneck, back, scapulars, rump, and upper tail-coverts plain dull olive or brownish olive; supra-auricular region and sides of neck dull yellowish buffy, the latter tinged with olive; chin, throat, and chest dull yellowish buffy; otherwise like adult female." And of the young female, "similar to the young male but paler and grayer above; supra-auricular and post-auricular regions pale brownish buffy; chin, throat, and chest still paler buffy, the chin and upper throat dull buffy whitish." The white tips of the greater wing coverts are tinged with yellowish.

I have not been able to trace the postjuvenal molt in the series I have examined but it apparently occurs in July and produces very little change, young birds of both sexes in their first winter plumage closely resembling the adult female at that season, though the crown and nape are grayer and the throat and breast are paler. I can find no evidence of a prenuptial molt. Young males evidently breed in this plumage and do not acquire the fully adult plumage until their second fall, or perhaps later. In Brewster's series, collected in March, three males are in this condition, of which he (1882) says that "two of them, although in unworn dress, are absolutely undistinguishable from adults of the opposite sex; the third (No. 77), however, has the throat appreciably tinged with the brownish-saffron of the adult male." This last may be a bird that is one year older, for Ridgway (1902) describes the "second year" male as "identical in coloration with the adult female." Judging from the series that I have examined, including all of Brewster's birds, I am inclined to think that the adult winter plumage is acquired at the first postnuptial molt, or when the bird is a little over one year old.

There can be no doubt, however, that young males breed in this immature plumage, for Price (1895) secured a pair that were feeding a brood of young, and the "male was not in fully adult plumage and was very similar in coloration to the female." Swarth (1904) writes: "The male bird breeds in the immature plumage, for on June 21, 1902, I assisted O. W. Howard in securing a nest, containing four eggs, the parents of which were indistinguishable in color and markings. * * * I was surprised at the large proportion of birds in this immature plumage that were seen. At a very liberal estimate I should say that the males in adult plumage comprised barely a third of the birds seen in the spring."

Adults have a complete postnuptial molt, mainly in July; all June birds that I have seen are in worn plumage, and August and September birds are in new, fresh feathers. The fall plumage of the male is similar to that of the spring male, but the colors of the head, neck, and chest are duller, more clay color, the back is more olive and the sides are browner. In the female at this season the crown is tipped with grayish and the throat and breast with buffy, while the sides are browner than in the spring; the white tips of the greater wing coverts are tinged with yellowish. The nuptial plumage is acquired mainly, if not entirely, by wear, the edgings wearing away and the colors becoming brighter.

Food.—Nothing definite seems to have been recorded on the food of the olive warbler, but its habit of creeping over the branches and twigs of the pines, much after the manner of the pine warbler, would seem to indicate that it was foraging for the many small insects that infest these trees. It is evidently one of the protectors of the pine forests. Brewster (1882b) says: "In their actions these Warblers reminded Mr. Stephens of *Dendroeca occidentalis.* They spent much of their time at the extremities of the pine branches where they searched among the bunches of needles for insects, with which their stomachs were usually well filled. Occasionally one was seen to pursue a falling insect to the ground, where it would alight for a moment before returning to the tree above."

Behavior.—One of the members of Henshaw's (1875) party brought in a specimen of this warbler, on September 20, "which he stated he had shot from among a flock of Audubon's Warblers and Snowbirds, which he had started from the ground while walking the pine woods. With the rest, it had apparently been feeding upon the ground, and had flown up to a low branch of a pine, where it sat and began to give forth a very beautiful song, which he described as consisting of detached, melodious, whistling notes."

W. E. D. Scott (1885), writing of his field work in the Santa Catalina Mountains in late November, says:

> Associated with flocks of the Mexican Bluebird (*Sialia mexicana*), which was, by the way, the only kind of Bluebird observed, was always to be found one and sometimes two representatives of the Olive Warbler (*Peucedramus olivaceus*). The Bluebirds were generally feeding on some insects in the tall pines, in flocks of from six to ten individuals. The Olive Warblers were on the best of terms with their blue friends, and as the Bluebirds were shy and restless they made it difficult to obtain or observe very closely their smaller allies. I did not in these pine woods see the two species apart, and became at length so well aware of the intimacy that existed between them, that I would fire at

> any small bird passing high overhead in company with Bluebirds. They were chance shots, certainly, but the only two small birds obtained flying in this way with the Bluebirds were Olive Warblers. * * * Generally they preferred the largest branches of the pines when they alighted, though I took one not more than three feet from the ground in a small bush. Their movements while feeding or searching for food are very deliberate, though I noticed now and again certain motions when at the extremity of a bough that reminded me of a Kinglet or a Titmouse.

Swarth (1940) says: "Though frequenting the tree tops to a great extent, they seem singularly tame and unsuspicious, and several times I have had one feeding in some of the lower branches, within arm's reach of me, without its showing the least sign of fear."

Voice.—The olive warbler has a rather loud, attractive, and distinctive note, but few observers have referred to it as a song. The "beautiful song" mentioned above consisted of "detached, melodious, whistling notes."

One of its whistling notes sounds very much like the *peto* note of the tufted titmouse and might easily deceive the listener. Scott (1885) observed that these warblers "had a call-note so like that of their associates [the bluebirds] as to be almost identical. It seemed to me only a clearer whistle of more silvery tone." Price (1895) saw a male alight on a twig near his mate, during nest-building, uttering "a liquid *quirt*, *quirt*, *quirt*, in a descending scale." Mr. Henshaw (1875) heard "a few strange Vireo-like notes coming" from an olive warbler. A bird that Dr. W. P. Taylor (MS.) watched in apparent courtship gave "a whistled call with descending inflection."

Field marks.—In general appearance and behavior the olive warbler suggests the pine warbler, especially as it creeps over the pines. The orange-brown head, neck, and breast of the adult male, with the conspicuous black band through the eye, is distinctive; these colors are much paler and more yellowish in the female, and the band through the eye is grayish. Both adults have two white wing bars, a white area at the base of the primaries and much white in the tail, the white areas being more restricted in the female. Young birds are much like the female (see descriptions of plumages).

Winter.—The olive warbler, as a species, is probably permanently resident throughout most of its Mexican and Central American range. But the northern olive warbler is evidently partially migratory, though some individuals, perhaps many, remain in Arizona during part, or all, of the winter. All of the 15 specimens taken by Stephens for William Brewster (1882b) were collected in March, probably too early to be migrants, and he says that Stephens had previously taken one in February 1880, evidently a wintering bird. Mr. Swarth (1904) writes: "I have not found this species very abundant in the Huachucas at any time, but it is probably resident to some extent, for I secured an adult male on February 21 when the snow was deep on the ground. During March I saw several more, all adult males and single birds, usually with a troop of Pygmy Nuthatches; but it was not until the first of April, when the other warblers were arriving, that they became at all abundant." Scott (1885) found them on the Catalinas under winter conditions, with snow on the ground, and says: "I think there can be little if any doubt that they are residents all the year." And Dr. W. P. Taylor (MS.) took one in the Santa Ritas on February 4, 1923. Just how far south go the birds that migrate away from Arizona does not seem to be known, but apparently they have not been detected beyond Chihuahua and Tamaulipas. Perhaps they do not migrate at all.

DISTRIBUTION

Range.—Southwestern United States to northern Nicaragua.

Breeding range.—The northern olive warbler breeds **north** to central Arizona (Baker's Butte and White Mountains) and central western New Mexico (Reserve). **East** to western New Mexico (Reserve and McKnight's Canyon); Chihuahua (Colonia García); southeastern Coahuila (Diamante Pass); and southwestern Tamaulipas (Miquihuana). **South** to southwestern Tamaulipas (Miquihuana) and southern Durango (Durango). **West** to Durango (Durango); Sonora (Sierra Saguaribo); and southeastern and central Arizona (Huachuca Mountains, Santa Catalina Mountains, and Baker's Butte).

Other races occur in southern Mexico and Central America.

Winter range.—The northern olive warbler is probably migratory to some extent, individuals withdrawing to the southern part of the range, but it is found in winter occasionally or in small numbers as far north as southern Arizona.

Egg dates.—Arizona: 14 records, May 23 to July 1; 7 records, June 2 to 18, indicating the height of the season.

DENDROICA PETECHIA AESTIVA (Gmelin)

EASTERN YELLOW WARBLER

Plates 24, 25

HABITS

The familiar yellow warbler, also commonly called the summer yellow bird or wild canary, is the best known and the most widely known of all of our wood warblers. It is one of the few birds that almost everybody knows by one of the above names. It is universally beloved as it comes to us in the flush of budding spring, gleaming in the shrubbery, like a rich yellow flame among the freshly opening leaves, or bringing to the apple orchards a flash of brilliant sunshine to mingle with the fragrant blossoms. As Dr. Chapman (1907) says: "In his plumes dwells the gold of the sun, in his voice its brightness and good cheer. We have not to seek him in the depths of the forest, the haunt of nearly all his congeners, he comes to us and makes his home near ours."

The yellow warbler, as a species, is also the most widely distributed member of its family. Its breeding range extends from the Atlantic to the Pacific in both Canada and the United States (110 degrees of longitude), and from the Barren Grounds in northern Canada to Mexico and the Gulf States (40 degrees of latitude). Its winter range covers 54 degrees of longitude and 31 degrees of latitude in Central and South America. Professor Cooke (1904) says: "The extreme points of the yellow warbler's range—northern Alaska and western Peru—are farther separated than the extremes of the range of the black-polled warbler, which is considered the greatest migrant of the family." But it must be remembered that the yellow warbler breeds much farther south than the blackpoll.

Spring.—The spring migration of the yellow warbler is long and partially circuitous; eastern yellow warblers that winter as far east as British Guiana probably make a roundabout flight to Central America, as there seem to be no springtime records for this bird in the West Indies and few for it in Florida. These birds may fly across the Gulf from Yucatán to Cuba and Florida, but the main flight is probably directly north from Yucatán to Louisiana and other points on the Gulf coast; they have been repeatedly seen flying northward in the middle of the Gulf. There is also a considerable migration along the coast of Texas, which I have personally observed.

The migration is also prolonged or very irregular, for according to the dates of departure given to me by Alexander F. Skutch (see under *Winter*), the last of these warblers do not leave Central America until the very last of April, or the first of May, after the first arrivals have reached New England; some of these records, however, may apply to one of the western races. After the birds reach the United States, the migration fans out northward and northeastward and seems to be more rapid. Of this Frederick C. Lincoln (1939) says: "Coming north from the Tropics these birds reach New Orleans about April 5, when the average temperature is 65° F. Travelling on northward much faster than does the season, they reach their breeding grounds in Manitoba the latter part of May, when the average temperature is only 47°. Encountering progressively colder weather over their entire route, they cross a strip of country in the 15 days from May 11 to 25 that spring takes 35 days to cross. This 'catching up' with spring is characteristic of species that winter south of the United States and of most of the northern species that winter in the Gulf States."

Territory.—Soon after their arrival on their breeding grounds the males begin to select their territories and then to defend them. Dr. S. Charles Kendeigh (1941) made a study of the territories of birds in a prairie community in northwestern Iowa, and writes:

> A special study of the Yellow Warbler indicated that territorial requirements included suitable nest-sites, concealing cover, tall singing posts, feeding areas in trees, and space, and that when certain of these factors were lacking, territorial relations became confused and the behavior of the birds was modified. * * * These warblers possessed territories that averaged about 150 feet in diameter, or approximately two-fifths of an acre. Even in locations where trees were included, the territories appeared to be of about the same size. The limits of the territory often did not coincide with the boundaries of the thicket in which the nest was located but extended over the neighboring grassland and often included parts of neighboring thickets. These territories were defended by the males partly by singing, although in shrubby areas lacking trees they were handicapped by lack of singing posts from which to proclaim their ownership and to advertise themselves. A few made use of fences from which to sing and also of tall posts and wire from an abandoned electric line that extended through the area. The role of the female in defense of territory was not determined.
>
> Probably due to this lack of singing posts and to the unusual abundance of birds, chasing was also extensively used as a defense measure, and during the height of the nesting season squabbling birds were a common sight all over the area. * * * Neighboring males seemed to lack any conception of the limits of each other's territories and moved about indiscriminately until chased out. No actual fighting was observed. * * * In other parts of the area where trees were available, the males commonly sang at a height of 18 feet, often up to a height of 45 feet, and chasing was not often observed.

For yellow warblers observed by Wendell P. Smith (1943) at Wells River, Vt., "territorial exclusiveness scarcely existed. In one season a Chestnut-sided Warbler's nest was located within five feet of that of the Yellow Warbler. The following species were represented by one nesting pair within a radius of thirty feet: House Wren, Catbird, Black and White Warbler, Chestnut-sided Warbler, Northern Yellow-throat and Indigo Bunting. Unless another individual came very close to the nest, no hostility was shown by either male or female. Too close an approach would bring a swift attack by one or the other, however, but for only a short distance when the pursuer would give up the chase."

A. D. Du Bois mentions in his notes a nest that was about 6 feet from the door of a screened porch in daily use and tells the following story about the territory involved: "Twelve yards south of this nest was a spruce tree. On several occasions the male met another male at this tree or beyond it. Both alighted at times in the treetop. Their boundary arguments had the appearance of pushing-contests in the air; and sometimes the contestants revolved in the air, about an imaginary axis between them. Once, while one of the warblers was in the tree, the other was seen to poise near the tree on fluttering wings, remaining for two or three seconds as nearly stationary in the air as a hummingbird. Twelve yards beyond the spruce I found a nearly completed nest in tall lilacs; but this nest was not finally occupied." Apparently, a second pair of warblers had tried to build a nest too near the territory of the first pair and had been driven out of the territory.

Courtship.—Mr. Smith (1943) says on this subejct:

> Courtship begins soon after arrival of the species. Within a period of from four to six days greatly increased singing is noted which marks its inception. Persistent and lively pursuit of the female by the male was observed, taking place within a restricted area (once within a radius of thirty feet). From one to four days elapsed before courtship was completed. Sexual union may not take place until nest building begins as the following observations in 1938 tend to show. Pursuit of the female began on May 23, continued on the 24th but frequent attempts at intercourse on the part of the male were unsuccessful. On the 26th copulation was seen to take place and on that date the nest was completed. * * * A period of several days intervened between nest completion and egg laying. During two seasons of rather intensive observation, this was two days.

Nesting.—Although we have come to regard the yellow warbler as a sociable and friendly little bird that seeks our company and builds its nest in the shrubbery about our homes, often close to our houses or in the bushes under our windows, such were not the original nesting sites and even now are far from being the commonest situations chosen, although they may seem the most evident.

The favorite nesting sites in southern New England are along small streams and brooks, around the borders of swamps and ponds and lakes, or in the more open brushy swamps (where the land is moist but not too wet) among willows, alders, elderberry and blueberry bushes, and other moisture-loving shrubs and small trees. They also nest in drier situations, in shrubbery about open spaces, along brush-grown fences and hedgerows and roadside thickets, or in cut-over lands grown up to sprouts and to thickets of wild raspberry, blueberry, and other bushes.

In such situations the nest is built in an upright fork or crotch of a bush or sapling, seldom over 6 or 8 feet from the ground or less than 3. Nests are sometimes built at higher levels in apple trees in orchards or in small trees about houses but rarely as high as 30 or 40 feet. Near human habitations, clumps of lilac bushes, often close to windows or doors, are decided favorites, while various kinds of ornamental shrubs about our gardens or grounds also provide suitable nesting sites.

Mr. Du Bois has sent me the data for 30 nests of the eastern yellow warbler found in Minnesota, Illinois, and New York. Among these, 4 were in willows, 3 each in lilacs and alders, 2 each in elms and box-elder saplings, and 1 each in a grapevine, an ash sapling, a spirea bush, and a currant bush. One of these latter, in an unspecified bush, was 14 feet from the ground, and another, in a wild grapevine climbing on a tree beside a coalbin, was 8 feet from the ground; those in the elms were 12 and 14 feet, respectively, from the ground. The remainder were mostly 5 feet or less above ground, the lowest being at a height of 2 feet, in a currant bush near a vegetable garden. He tells of a nest that was built in a wild rose bush at the edge of a small run near his vegetable garden; "this nest was so compactly fabricated as to hold water for some time; I saw about one-fourth inch of water standing in the bottom of it after a heavy rain."

On two occasions, he has found the new nest to have been built on top of the old nest of the previous year.

F. G. Schrantz (1943) has published the results of a careful study of 41 nests of the eastern yellow warbler in Iowa, during 1938 and 1939, on the restricted grounds of the Iowa Lakeside Laboratory. Among those at heights from 1½ to 5 feet from the ground were 27 in wolfberry bushes (*Symphoricarpos occidentalis*), 8 in young saplings of boxelder (*Acer negundo*), 2 in wild gooseberry (*Ribes gracile*), 1 in wild currant (*Ribes floridum*), and 1 in an introduced species of honeysuckle. One nest was in a cottonwood at a height of about 10 feet, and another in a boxelder about 15 feet above ground.

Dr. Roberts (1936) says that in the prairie regions of Minnesota, where underbrush is scarce, the yellow warblers build their nests in the cottonwoods in the tree-claims, "against the trunks of the large trees, supporting them on small lateral branches and twigs. * * * These arboreal nests are often fifteen to twenty-five feet from the ground and occasionally still higher." And in the huge cottonwood trees along the river, he has seen nests placed at elevations of 40 to 60 feet. Others have also recorded nests at heights of 40 and 60 feet.

In Dr. Kendeigh's (1941) prairie community, "twenty out of twenty-nine nests were placed in buckbrush, with the rest in boxelder, lilac, willow, or currant. The buckbrush is a low bush usually three or four feet high, growing in rather dense thickets in the open, especially in grassy areas of *Poa* and *Agropyron*. Nests placed here varied between two and three feet above the ground. The nest found closest to the ground (18 inches) was, however, in a small boxelder. In taller shrubs and trees, the nests were found up to about seven feet above the ground."

Mr. Schrantz (1943) watched the building of a nest from the first stages of construction to its completion and the laying of the first egg, covering a period of 4 days.

> Construction was first observed at 7:45 a. m., on June 12, 1939, when a female Yellow Warbler was seen carrying a tuft of plant-down into a small boxelder sapling. Upon examination, a mass of plant-down about one and one-half inches in diameter was found at a measured height of two feet three inches from the

ground in the fork of the sapling. During an hour of observation the female continued to carry plant-down at intervals of about four minutes although once it did not bring any material for twenty minutes. At noon the plant-down mass had increased to about three inches in diameter and was more compactly pushed into the fork. By 6:45 p. m., there were many strands of plant fibers and grasses woven around and through the plant-down in such a way as to wrap and bind the plant-down around the small twigs of the fork. The nest was just assuming a cup-shaped structure. The female was now bringing large loads of a mixture of grasses and plant fibers and working at a rate of about one trip every four minutes. The first day's building was completed at 7:55 p. m. The nest was now partially surrounded with woven plant fibers and grasses with a slight formation of a rim.

On the second day the work continued and the "rim consisted of plant fibers and grasses woven partly into the original down but mostly into the sides and around the top. At 6:45 p. m., the nest appeared completed with a well-formed cup, plant-fiber and grass rim, and a plant-down floor." The third day was partly rainy and little was accomplished but "by 8: 00 on the fourth morning, the plant-down inside the nest was smoothed out and contained a few strands of fine grasses. * * * During all the observations on the building of this nest the male at no time was seen to bring any nest material. However, since there were many hours during the day when no observations were made, it is possible that he might have helped at some time. * * * At 6: 30 a. m., the following day, one egg was found in the nest. * * * The dates of the beginning of construction and the dates the first eggs were laid were obtained for two other nests, and the time which elapsed in both cases was four days."

Only the female was seen to take part in the building of the nest that Mr. Smith (1943) watched, but my experience was somewhat different. On May 10, 1942, I found a pair of yellow warblers building a nest in the top crotch of a blueberry bush, close to the side of a country road. They were very tame and gave me an unusual opportunity to watch them for over an hour at short range. I parked my car within 5 feet of the nest and took motion and still pictures, with cameras even nearer. The nest was nearly done and they were putting in the lining. Both birds helped in the work, but the female did nine-tenths of it. She came at frequent but rather irregular intervals, bringing a billful of soft plant down that looked like the down from ferns, some of which I found growing nearby, and to which I saw her making frequent trips; the fronds of the cinnamon ferns were just unfolding. This material she deposited in the cup of the nest and settled her body down into it, smoothing the lining into place by turning her body around in different directions, pressing it down with her body and up against the sides of the cup with a sidewise motion of the wings. Occasionally she reached over the rim of the nest, smoothing it with her neck and tucking in the loose ends with her bill. The bottom and outside of the nest seemed to be about finished; one side of it, opposite the most exposed side, was anchored to a nearby twig with strands of plant fiber. The female seemed utterly fearless; the male was more shy, but his streaked breast was occasionally seen at the nest.

Robie W. Tufts tells me that he has seen the male at the nest; he saw a male come to a partly finished nest sit in it for over a minute as though testing the workmanship and sing twice while sitting there. The male is always very attentive during nest-building, following his mate back and forth on her trips for material and keeping close to her most of the time. His interest in the nest is so keen that it would be strange if he did not sometimes help.

The eastern yellow warbler builds a neat, strong nest, the materials being firmly and smoothly interwoven and the lining compactly felted. Five local nests before me show quite a variation in the materials used and in their arrangement. The most obvious material, occurring more or less in all of the nests, consists of the silvery-gray strands from the last-year's stalks of milkweed, Indian hemp, or other similar dead weeds. One nest has a great mass of such material below it on one side, evidently to fill in space in the fork that supported it; mixed with this material are a few strands of grasses, other shredded weed stems, bits of wool, and gray fur. Although this nest is far from neat externally, the cup of the nest is well and firmly made of finer silvery fibers and fine grasses, cinnamon-fern down, with which it is profusely lined, and a few fine white hairs. The rim is strongly reinforced with horsehair and decorated with the cinnamon down. This nest, the largest of the lot, measures nearly 5 inches in height and 3 inches in diameter, externally. The smallest and the neatest of the five is made of finer strands of similar materials, without a trace of cinnamonfern down, the whole being very firmly and smoothly woven into a compact little nest; the rim is neatly made of very fine grasses, and it is smoothly lined with white plant-down; it measures only 2 inches in height and 2¼ inches in diameter, externally. Grasses enter largely into the construction of all the nests. One in particular is lined with both white and buff plant-down and a little very fine grass, and has a solidly built rim of strong grasses very firmly interwoven; the foundation consists of dry brown and gray lichens, or mosses, and a lot of cotton waste, such as is used to clean machinery. A two-story nest, which measures 4 inches in total height, is profusely lined with white cotton in both stories. There is little difference in the internal measurements, which vary from 1¾ to 2 inches in diameter, and from 1¼ to 1½ inches in depth.

None of my nests contain any feathers, but Dr. Roberts (1936) tells of a nest that was made entirely of chicken feathers, with "not a bit of material of any other kind." It was built in a jewelweed

(*Impatiens capensis*), but after a brisk wind and a sharp shower both nest and weed were completely wrecked. He shows a photograph of a nest built almost entirely of sheep wool, and speaks also of the use of fine strips of inner tree bark, which probably occur in many nests, of quantities of fine, white, silky pappus from various plants, and of a few feathers. Du Bois mentions in his notes a nest in which five soft, white chicken feathers were woven into the lining, the largest one when stretched out measuring 3¾ inches; there were also two or three feathers in the body of the nest. In my collection is a beautifully camouflaged nest that was built in the upright crotch of a small poplar and seems to be made very largely of white cotton mixed with fine, light-colored fibers. It is lined with cotton, and with a few green poplar leaves fastened to the exterior, the whole being firmly bound with some of the finest fibers and with spider silk, the light-colored material matches the bark of the tree so closely that it might easily be overlooked.

T. E. McMullen has sent me his data for over 40 nests of the eastern yellow warbler found in New Jersey and Pennsylvania. The lowest nest was only 1 foot from the ground in a small bush, and the highest was 30 feet up in an elm. In addition to the shrubs and trees mentioned above he lists arrowroot, blackberry briers, elder, holly, Osage-orange and buttonbushes, birch, wild cherry and oak saplings, and a pear tree.

The well-known habit of building nests one or more stories over cowbirds' eggs will be discussed under the enemies of the yellow warbler.

Eggs.—Four or five eggs made up the usual set for the eastern yellow warbler; sometimes as many as six are found, or as few as three. In shape, they vary from ovate to short ovate, or rarely show a tendency to elongate ovate. They are only slightly glossy. These handsome eggs show a great variation, both in ground color and in markings. The most common ground colors are grayish white or greenish white but some eggs have a bluish white or even a soft, pale green ground color. The spots and blotches show an even greater variety of colors. Shades of "fuscous," "olive-brown," "citrine drab," "buffy brown," "buffy olive," "light brownish olive," "raw umber," "metal bronze," or "tawny olive" are intermingled with undertones of "deep gull gray," "neutral gray," "purplish gray," "pale purplish gray," "mouse gray," or "buffy brown." The markings tend to form a wreath around the large end where, on the heavily-marked types, the blotches overlap the undertones and an almost endless number of shades are formed. Sometimes a few spots or scrawls of dark "mummy brown" or "olivaceous black" stand out in sharp contrast to the other markings. Although the eggs are usually well marked, sometimes with blotches a quarter of an inch in diameter, often they are only finely speckled with the gray undertones. The measurements of 50 eggs average 16.6 by 12.6 millimeters; the eggs showing the four extremes measure **17.8** by 13.2, 17.8 by **13.7, 15.2** by 12.7, and 15.8 by **11.7** millimeters (Harris).

Young.—The incubation period for the eastern yellow warbler has been recorded as from 8 to 11 days (most observers place it as about 11 days for each individual egg); often, but not always, it begins before the set is complete, making the period appear shorter for the first egg laid. Eggs are generally, though not always, laid on successive days, but at times 1 or 2 days intervene between layings. Incubation is performed wholly by the female. The male stands guard near the nest and feeds the female while she is sitting, but she also leaves occasionally to feed herself. The young remain in the nest from 8 to 15 days, according to several observers, but here again the normal time is probably between 9 and 12 days, if they are undisturbed.

Harry C. Bigglestone (1913) describes the hatching process as follows:

> At about 5:30 a. m. on July 3 the writer was attracted by a peculiar rolling motion of the egg in the nest, and noticed upon closer observation, that the shell bulged out in a ring around the middle or a little nearer the smaller end; and soon it began to crack at this place. The egg raised on the small end, leaning against the side of the nest, and the young bird freed himself from the shell by a series of pushes and kicks by the head and feet, respectively. The head escaped from the larger part of the shell and the lower part of the body from the smaller end. The crown of the head and the median line of the back of the nestling were downy. This entire process covered a period of less than four minutes.

The empty shells were broken up and eaten by the parents. He says that brooding was carried on entirely by the female, except that he once saw the male brooding for 7 minutes, and adds:

> The female was more careful in brooding the young during the first few days. She would stop for intervals throughout the day, while feeding, and brood the young. Her way of completely covering the brood was to fluff out the under coverts against the rim of the nest and bring the wings down, just inside, so as to effectually close the nest.
>
> * * * The female had different brooding attitudes for the varying circumstances. For protection against the cold of early morning she brooded in the manner described above, completely covering the young. Through the rains she brooded in much the same way as for cold, sheltering the young, so that after an unusually heavy downpour, the nest remained perfectly dry inside. During the heat of midday she usually stood in the nest with wings spread, shielding the young, but without shutting off the circulation of the air. On the contrary, at times she gently flapped her wings, as if fanning the young. During the strong winds she stood in the nest with wings outstretched, and leaned in the direction of the wind, so as to secure a delicate balance and at the same time keep the young in the nest.

Feeding of the nestlings was carried on about equally by both male and female parents for the first 7 days, after which the male was frightened away by a snake and did no more feeding, the female carrying on for the next 4 days. During observations covering nearly all of 10 full days and part of another there were 2373 feedings, 813 by the male and 1560 by the female, there being only 33 feedings during the whole of the last day. "During the first three or four days when the female was brooding, usually the male gave her the food, which she distributed to the nestlings." Some of the food had to be broken up before it was given to the young; and sometimes it had to be thrust down their throats. There were 331 feedings of unrecognized food, and 553 of unidentified insects. The identified food consisted of 659 green worms, 326 fly worms, 162 other worms, 147 May flies, 103 moths, 75 millers, 65 mosquitos, 26 larvae, 25 grasshoppers, 23 spiders, 18 ants, 14 grubs, 8 beetles, 4 damsel flies, 2 tree hoppers, and 1 bee. Feeding began at from 4:29 to 4:50 a. m., and ended at from 7:36 to 8:04 p. m., the average feeding period being 15 hours and 30 minutes per day. The parents were not seen to follow any system of rotation in feeding the young. "At no time while the nest was under observation did the parents feed by regurgitation," though the parents on several irregularly occurring occasions were seen to insert an apparently empty bill into the mouth of a nestling, but it was long after hatching. The excreta were removed by both parents; they were eaten during about the first half of the nest life and carried away after that; the female did most of this. The parents were very watchful of the young, and were seen to drive away such birds as the cowbird, blue jay, wren, chickadee, brown thrasher, kingbird and blackbird, if they came too near the nest; the only bird that was not driven away was a catbird. The presence of a garter snake at the base of the bush caused great excitement; the snake was seen to climb up into the bush and carry off one of the young when it was about six days old; the young bird was dead before it could be rescued.

Schrantz (1943) writes: "The Yellow Warblers are hatched naked except for a scanty amount of down and are an interesting sight with their large bulging eyes and abdomen. It was observed that the eyes were commencing to open on the third day after hatching. By the fifth day the young can completely open their eyes, but in many cases would immediately close them when the nest was approached. At this age they would also duck down in the nest as if trying to hide. A slight tapping on the nests would cause a rapid outstretching of necks with open mouths." Bigglestone (1913) found that almost any slight noise near the nest would produce the same results. Studies of weights by Schrantz showed that—

> the young averaged, when hatched, 1.27 gms.; at one day old, 1.87 gms.; at two days old, 2.95 gms.; at three days old, 4.36 gms.; at four days old, 5.57 gms.;

at five days old, 7.26 gms.; at six days old, 8.20 gms.; and at seven days old, 8.78 gms. * * *

Of the 168 eggs in forty-one nests, 119 eggs, representing 70.83%, hatched. Thirty-four eggs, representing 20.24%, disappeared due to wind, abandonment of nest, and unknown causes. Fifteen eggs, representing 8.93% were addled, two of which were buried with a Cowbird's egg. Of the 119 nestlings, twenty-eight disappeared. This represents 16.66% of all eggs laid. Four of them were seen dead in the nests. The others disappeared from unknown causes. Therefore a total of 91 fledglings, representing 54.17% of the original 168 eggs, left the nest. * * *

After all the young left a nest, the parent birds could be found feeding them in the immediate vicinity of the nest for a period of about three days. After this time the birds became more dispersed from the nesting site, but could still be found in the vicinity for a week or ten days.

An unusual casualty is recorded in the following note sent to me by Dr. Harrison F. Lewis: "A nest of this species which I found in a sheep-pasture, was largely built of wool, presumably gathered from the neighboring bushes, where it had been left by the sheep. One of the young birds in this nest died as a result of having threads of the wool in the nest become entangled about its tongue and bill. Another member of this brood became entangled in a similar fashion, but I released it."

Plumages.—Dr. Dwight (1900) calls the natal down "mouse-gray," and describes the juvenal plumage, in which the sexes are alike, as "above, pale olive-brown. Wings clove-brown broadly edged with bright olive-yellow paling at tips of the quills, the edge of the outer primary bright lemon-yellow. Tail pale clove-brown, the inner webs of the rectrices lemon-yellow, the outer edged with olive-yellow. Below, pale sulphur-yellow, unstreaked."

The first winter plumage is acquired by a partial postjuvenal molt early in July that involves the contour plumage and the wing coverts but not the rest of the wings or the tail. He describes the young male as "above, pale yellowish olive-green, the edgings of the wing coverts paler. Below, dull lemon-yellow obscurely, narrowly and sparingly streaked on the throat and sides with pale chestnut." The female is paler throughout and has no streaking.

The first nuptial plumage is acquired by a partial prenuptial molt in early spring, "which involves most of the body plumage, the wing coverts and the tertiaries, but not the primaries, their coverts, the secondaries, nor the tail. The whole plumage becomes golden lemon-yellow, greener above and [in the male] brightly streaked on the throat, breast and sides with pale chestnut, somewhat veiled by the feather edgings. The forehead and crown are yellower than the back and usually chestnut tinged. The tertiaries and wing coverts are broadly edged with bright lemon yellow." The female in this plumage is yellower than in the fall and has a few obscure chestnut streaks below. Old and young birds are now very much alike, often practically indistinguishable, except for the worn juvenal wings and tail.

Adults have a complete postnuptial molt in July before or while they migrate and a partial prenuptial molt, as in the young bird, before they arrive in the spring. In El Salvador, according to Dickey and van Rossem (1938), "both adults and young of the year were in complete fall (postnuptial) plumage by the time they arrived. * * * An adult male taken April 10 is in the midst of the spring (prenuptial) molt and presents an extremely ragged appearance. Another, collected on April 24, has entirely finished this molt."

In both adult male and female plumages the colors are richer and the streakings below heavier than in the young bird, but the female is always duller in color and the streaking is less prominent or entirely missing.

Food.—Edward H. Forbush (1907) writes of the food of the eastern yellow warbler in Massachusetts:

> It would be hard to find a summer bird more useful among the shade trees or in the orchard and small-fruit garden than this species. Almost entirely insectivorous, it feeds on many of the greatest pests that attack our fruit trees, vines and berry bushes. Whenever the caterpillars of which it is fond are plentiful, they form about two-thirds of its food. It is destructive to the small caterpillars of the gipsy moth and the brown-tail moth, and is ordinately fond of cankerworms and other measuring worms. Tent caterpillars are commonly eaten. Small bark beetles and boring beetle are eaten, among them the imago of the currant borer. Weevils are greedily taken. A few useful beetles are sacrificed; among them ground beetles, soldier beetles, and small scavenger beetles. The Yellow Warbler has some expertness as a flycatcher among the branches, and seizes small moths, like the coddling moth, with ease, but apparently does not take many parasitic hymenoptera, although some flies are taken. Plant lice sometimes form a considerable portion of its food. No part of the tree where it can find insect food is exempt from its visits, and it even takes grasshoppers, spiders, and myriapods from the ground, grass, or low-growing herbage.

He (1929) says elsewhere: "It attacks none of the products of man's industry, so far as our records go, except the raspberry, of which it has been known to eat a few occasionally."

S. A. Forbes (1883) reports that 5 stomachs from a canker-infested orchard contained 94 percent insects; of which 66 percent were cankerworms, Coleoptera 23 percent, spiders 6 percent, Hymenoptera 2 percent, and Hemiptera 1 percent. A. H. Howell (1907) found a cottonboll weevil in one stomach from Texas; E. R. Kalmbach (1914) reports that of seven Utah stomachs, two contained alfalfa weevils, forming 25 percent of the food in one; and Prof. Aughey (1878) found an average of 11 locusts in 7 Nebraska birds.

Behavior.—The gentle little yellow warbler is not only one of the prettiest but one of the tamest and calmest of our bird neighbors. It comes to us in the most friendly and confiding manner to build its cozy nest and rear its little golden family in the lilac bush under our window or in the climbing rambler over our porch. Nor does it mind our company in the least as we watch its home life almost within arm's reach. I have sat for an hour within a few feet of a pair of these lovely birds and watched them building their nest. The many fine photographs that I have received show that it is an easy subject for close-up pictures; the near presence of the camera does not seem to disturb them in their feeding routine. Many intimate home-life studies have been very successful, for they are brave and devoted parents. Robie W. Tufts (1927) has had a male yellow warbler come at least twice to feed a brood of young that he was holding in his hand, and once he even wiped his bill on his thumb. It is such displays of confidence that endear us to the little golden gem.

Voice.—Aretas A. Saunders contributes the following study of the song of this warbler: "The song of the yellow warbler is a bright, sweet and musical refrain of about 8 notes. My records show that the number varies from 5 to 15 and averages 8½. The songs are quite variable in form, so much so that it is the quality, rather than the form, that makes the song recognizable. This quality is difficult to describe, yet that quality, after a little familiarity, is easily recognized; the tones, though musical and pleasing, are not quite clear, but slightly sibilant.

"Two forms of the song are fairly typical, but there are a number of others that vary so much that they are quite unlike either of these. The most common form begins with four or five notes of even time, and all on the same pitch. These are followed by two or three more rapid notes on a different pitch, usually lower; and the song is ended by one or two notes back on the original pitch and time. Such a song, in its simplest form, might be written *see see see see tititi see.* Of my 87 records, 45 may be classed as this form.

"The second form begins in the same manner, but has all the notes of equal time, and the last three or four successively lower in pitch. I have records of 24 such songs. There remain in my records 18 songs so variable that they belong to neither of these forms, and yet no two of them are similar in form. A number of songs of the different forms begin with slurred notes, the slurs being about equally up or down in pitch.

"Songs vary from 1⅕ to 2 seconds in length, averaging about 1⅖ seconds. The pitch varies from A'''' to D''''', only three and a half tones altogether. Single songs vary from one to two and a half tones in range of pitch, averaging about one and a half tones. Individual birds may sing as many as three different songs, and sometimes sing two different songs in regular alternation.

"Singing continues from the first arrival in migration until the third week of July, ceases for a short time, but is usually revived in August, and is to be heard irregularly until the birds depart for the south."

Francis H. Allen gives me his impressions of the two common songs as follows: "One of these I have been accustomed to render as *wee see wee see wiss wiss′-u*. Occasionally the final *wiss′-u* is doubled. The other of these two songs goes something like *wee wee wee witita weet*, without the drop in the pitch that the first song has at the final note. I have also heard a song of five single notes with no variation in pitch or tempo—*weet weet weet weet weet*. Besides a rather sharp *chip*, which is the ordinary call-note, I have heard a *dzee* from a yellow warbler."

The yellow warbler is an early riser. Mr. Smith (1943) heard one begin singing at 4:56 a. m., "daylight time," and another at 4:05, "but with only one song until 4:08 when seven were given during the space of one minute. During the song period of fifty minutes, 197 songs were given." Dr. Charles W. Townsend told Mr. Allen that he heard one at Ipswich, Mass., on June 13, 1908, that began singing at 3:10 a. m., but this was standard time.

Dr. Winsor M. Tyler (1937) mentions a peculiar note, heard during the migration in August, which had puzzled him for nearly 30 years until he finally traced it to an eastern yellow warbler. "As we walk under the trees, listening, we hear a long, wild, high, sharp bird-note, abrupt, and very slightly vibratory, lasting perhaps half a second. It is a characteristic sound of this time of year, and we hear it best on these quiet, silent days. It comes from a bird moving restlessly up in the trees, and before we can see the bird, it is gone. * * * In pitch, it suggests the call of a migrating Ovenbird, but it is too long-drawn-out; it suggests the *chip* of a Northern Water-Thrush in its sharp abruptness, but again it is too long."

According to Albert R. Brand (1938) there is considerable variation in the pitch of the song of the eastern yellow warbler, from 8,775 vibrations per second in the highest note to 3,475 in the lowest note, and with an approximate mean of 5,900 vibrations per second. This is far below the approximate mean of 8,900 for the black-poll warbler, but well above the average of 4,000 for all passerine birds.

Field marks.—One hardly needs field marks to recognize a yellow warbler; it is the yellowest of all our warblers at all seasons, even the wing and tail feathers are edged with yellow, and there is no white in either wings or tail. The youngest birds likewise show some yellow on the under parts and in the flight feathers. See the descriptions of plumages for details.

Enemies.—The arch-enemy of the yellow warbler is undoubtedly the cowbird. This warbler is one of the very commonest victims of this parasite, and comparatively few of its nests are not visited at least once by a cowbird in regions where the latter is very common. Dr. Friedmann (1929) has about 500 records of such imposition on the eastern yellow warbler. Everyone who has examined nests of this warbler in any number has found one or more eggs of the cowbird in some of the nests. This parasitic habit has cost this species of warbler many extra hours of unexpected labor and the loss of many eggs and young. But the most interesting fact about it is that the warbler has found a way to combat the evil and, in many cases, to defeat the plans of the cowbird, by either deserting the nest in which the strange egg is deposited or by building a second floor over it and leaving the alien egg to cool off in the "cellar."

The yellow warbler is not the only bird that has learned to do this occasionally, but it is the only one that does it regularly and persistently in spite of repeated contributions from the cowbird. Even if the warbler has one of its own eggs in the nest when the cowbird's egg is deposited it may bury both the eggs by building a story above them, but if there are two or three warbler's eggs in the nest before the alien egg appears, the warbler may feel obliged to incubate and hatch out the stranger, with the usual results of her own young being crowded out and lost. Two or more cowbird's eggs are almost sure to be deserted or buried. But the cowbird is very persistent and keeps on laying, as successive stories are added to the nest by the energetic and persevering warblers. Two-story nests are very common, and as many as three, four, five, and six stories have been recorded. Mr. Forbush (1929) was told by Dr. H. F. Perkins "of one case where a six-storied nest was built, with a cowbird's egg in every one." Mr. Du Bois tells me of a new nest he found in a low bush, with another nest, about half completed and only about a foot below it, containing a fresh, cold cowbird's egg. Out of 43 nests found by Dr. George M. Sutton (1928) in Pymatuning Swamp, Pa., "a Cowbird egg was found in only one nest. This is most unusual, but is due, as elsewhere stated, to the protection against these parasites afforded by the Red-winged Blackbirds which would not tolerate a Cowbird anywhere about the marshes."

Snakes sometimes destroy the young, as related above; squirrels, blue jays, and other predatory mammals and birds rob the nests; and the adults must always be on the alert to escape the many enemies that prey on all small birds.

Harold S. Peters (1936) records only one louse, *Philopterus subflavescens* (Geof.), as an external parasite on the eastern yellow warbler.

Fall.—The striking feature of the fall migration of the eastern yellow warbler is its earliness. The birds begin to move away from their nesting haunts as soon as the young are able to take care of themselves, and the southward migration is well under way before midsummer. Smith (1943) says that, in Vermont, "during many seasons, the species is not seen later than July. Departure dates for local summer residents range from July 15 to the 30th. Later records occur between August 18 and September 9th." These later records are probably for birds from farther north. There seems to be a wide spread between the times that the earliest and latest birds leave.

Dr. L. H. Walkinshaw writes to me: "To me it is interesting how soon after nesting has been completed these warblers disappear. After July 10, it is very hard to find one of the species here in Michigan, and after August 10, almost impossible. It does stay some in certain good feeding areas, but the majority have left long before August." According to Milton B. Trautman (1940), the migration in Ohio begins early in July, reaches its height during the first half of August, and only stragglers are seen after September 10.

Arthur T. Wayne (1910) says that, in South Carolina—

> the Yellow Warbler is positively uncommon during the spring migrations, but exceedingly abundant in summer and autumn. * * * By July 4, the return migration takes place and a few young birds arrive, but it is not until the 10th or 15th that they are common. * * * The habits of the birds are entirely changed, however, in summer and autumn, for then they frequent the cotton fields, as well as lands which have been planted with peas for forage. It is also not unusual in autumn to see as many as twenty or more of these little birds far out in the salt marshes, where they find food in abundance. The species is so very abundant in late summer and autumn that it is not unusual to encounter hundreds of individuals in a few hours on plantations or in close proximity to salt water.

Prof. W. W. Cooke (1904) writes: "Though in migration the yellow warbler occurs in Florida as far south as Key West and is sometimes fairly common in northern Florida, the numbers that migrate through the southern part of the State must be very small, for not a bird passing north or south has been reported from any of the Florida lighthouses. The migration route of the yellow warblers that breed near the Atlantic coast is evidently southwest to northern Georgia and Alabama, and then across the Gulf of Mexico."

Perhaps the main flight from Florida and the other Gulf States is across the Gulf to Yucatán and then down through Central to South America, for there seem to be no records for Cuba for the eastern yellow warbler. There is a regular migration along the coast of Texas. Dickey and van Rossem (1938) say that "the eastern yellow warbler migrates through El Salvador in fair numbers, but no specimens were taken at any time during the winter. In the fall, particularly, great numbers are in evidence. The first arrivals reached Lake Olomega on August 1, but the main body did not begin to drift through until about the middle of that month."

Frederick C. Lincoln (1939) remarks: "Redstarts and Yellow Warblers, doubtless the more southern breeders in each case, have been seen returning southward on the northern coast of South America just about the time that the earliest of those breeding in the North have reached Florida on their way to winter quarters."

Winter.—Dr. Alexander F. Skutch contributes the following winter notes: "This morning as I sat at breakfast a yellow warbler flitted among the shrubbery outside the window. Here in Central America, through 8 or 9 months out of the 12, this well-known bird occupies the same place in dooryard, garden, hedgerow and scrubby pasture as during its briefer sojourn in the more northerly regions where it nests. None of the resident warblers of Central America is quite so abundant and familiar about human dwellings. Everywhere it avoids the heavy forest and prefers the sunlight that floods the clearings made by man.

"It is one of the first of the visitants from the North to arrive in Central America, appearing in Guatemala as early as August 9, reaching Honduras by at least the fourteenth, Costa Rica by the seventeenth, and Panamá by the twenty-second of the month. These early dates are for the Caribbean lowlands, along which it appears to migrate. It arrives later on the Pacific side of the Isthmus, especially in Costa Rica, where it has not been recorded before August 24, at San José, and not until September 11 in the Térraba Valley, still more isolated from the Caribbean flyway by lofty, forested mountains. But by the end of September, it is well distributed as a winter resident over both coasts of Central America, and in the interior up to at least 5,000 feet, becoming rarer at the upper limit of its altitudinal range. Much above 5,000 feet it apparently does not winter; but it is occasionally seen in September in the high mountains as a bird of passage. A heat-loving warbler, it is most common in the lowlands where, in the plantation districts of northern Central America during the winter months, it is among the most abundant birds, whether resident or migratory.

"Although a number of wood warblers which winter in the Central American highlands are gregarious, those that center in the lowlands are typically solitary. In this, the yellow warbler is no exception. Each wintering bird appears to have its own territory, from which it attempts to drive others of its kind. Trespassers are scolded with insistent *chips;* or more rarely, soon after his arrival, a male will sing while defending his claim. Near San Miguel de Desamparados, Costa Rica (4,600 feet), on October 1, 1935, I made the following note: 'This morning, which for a change was bright and calm, I heard a yellow warbler singing in the low fig trees near the house. Upon going out to look, I found that there were two yellow warblers in the trees. One was trying to drive the other away; but the pursued always circled around and returned. I watched them for a long time; but this indecisive action continued without any change in the situation. In the intervals of the pursuit, the warblers (or at least one of them) would sing, but in a low and imperfect fashion, far inferior to the yellow warbler's summer song.' Again, on October 31: 'After the Wilson warbler, the most abundant winter visitor is the yellow warbler. The bird who on October 1 drove its competitor out of the fig trees beside the house still retains these trees and the surrounding *Inga* trees as its domain.'

"The yellow warbler sings far less while in Central America than many other wintering species. Exceptionally, one will be found singing profusely. In early October, 1934, I came upon such a bird among the coffee groves of a great plantation on the lower Pacific slope of Guatemala. His behavior was so far out of the ordinary that I am tempted to copy in full the notes I made upon it at the time: October 5—On the afternoon of my arrival at 'Dolores,' I went out for a walk through the coffee groves. From among the 'chalum' (*Inga*) trees which shaded the coffee bushes, I heard a bird's song which seemed to belong to a warbler; but I did not recognize it as the utterance of any species I knew. After searching for a time among the tree-tops, I spotted the singer, and was surprised to find him a yellow warbler. He was apparently a young bird, for he lacked the chestnut splashes along the sides which distinguish the mature males. He repeated over and over again his little song of four or five notes, which was so unlike the familiar song of the yellow warbler in the eastern United States that I did not at first recognize it; but once I had identified the singer, I realized that I was listening to a shortened and modified form of the typical song.

"As I stood watching and listening to this eccentric warbler, the rain clouds which had been gathering darkly in the west began to surrender their pent-up waters; and the sudden shower approached across the plantation with the roar of a myriad fat drops striking against the large leaves of the Ingas and the far larger ones of the bananas which shaded the plantation. I took refuge from the rain beneath the broad expanse of a banana leaf, which completely shielded me from the beating downpour. Soon the heavy shower exhausted itself; and I emerged from beneath my green roof. The warbler, who had taken shelter from the shower somewhere in the foliage above me, resumed his cheerful singing.

" 'On the next two days, I passed by the spot where I had heard the warbler singing, on the way to and from my botanical collecting ground. Morning and afternoon, I heard the same voice in the same part of the coffee plantation, where the bird seemed to have fixed his residence.'

"Yellow warblers may sing in Central America in the spring as well as the fall. Last year, the male yellow warbler that wintered about my house in Costa Rica sang briefly in the early morning from April 12 to 24. After April 28, I saw no more of his kind in the vicinity.

"From November 1936 until February of the following year, a yellow warbler slept every night in a bush of *Hibiscus mutabilis* beside my cabin in Rivas, Costa Rica. He rested upon one of the long leaf-stalks, where the broad blades of the higher leaves formed a roof above him, but he was exposed on the sides and easily visible from the ground. He always slept alone.

"Early dates of fall arrival in Central America are: Guatemala—passim (Griscom), August 9; Sierra de Tecpán, 8,500 feet, September 4, 1933; Huehuetenango, 6,500 feet, September 11, 1934. Honduras—Tela, August 14, 1930. Costa Rica—Puerto Limón, August 17, 1935; San José (Cherrie), August 24; Cartago, September 6, 1938; Basin of El General, 2,000–3,000 feet, September 13, 1936 and September 11, 1942. Panamá—Canal Zone (Arbib and Loetscher), August 22, 1934.

"Late dates of spring departure are: [British Guiana (Beebe), April 10.] Panamá—Barro Colorado Island, April 23, 1935; Almirante, April 29, 1929. Costa Rica—Basin of El General, April 30, 1936, April 29, 1937, May 7, 1939, May 3, 1940, April 28, 1942; San José (Cherrie), May 11. Honduras—Tela, May 9, 1930. Guatemala—passim (Griscom), May 6; Los Amates, Motagua Valley, May 11, 1932.

Todd and Carriker (1922), reporting for the Santa Marta region of Colombia, say that the eastern yellow warbler is "a common winter resident throughout the whole of the lowlands and lower foothills, but rare above the coastal plain. It frequents shrubbery, open ground with scattering bushes, the low growth along the banks of streams and the sea-beach, etc.—the same kind of covert in general to which it is so partial in the breeding season."

DISTRIBUTION

Range.—North America, northern South America and the West Indies.

Breeding range.—The yellow warblers of North America breed **north** to north-central Alaska (Kobuk River and Fort Yukon); northern Yukon (Potato Creek, 20 miles above Old Crow River); northwestern Mackenzie (Richard Island, Fort Anderson, Lake St. Croix, and Oot-sing-gree-ay- Island, Great Slave Lake); northern Manitoba (Lac Du Brochet, Churchill, York Factory, and Severn House); and central Quebec and Labrador (Richmond Gulf, Grand Falls of the Hamilton River, probably Northwest River, and Cartwright). **East** to eastern Labrador (Cartwright); Newfoundland (St. Anthony, Twillingate, and St. John's); Nova Scotia (Cape Breton Island, Halifax, and Yarmouth); and the Atlantic coastal region south to eastern and central North Carolina (Pine Island, Lake Mattamuskeet, Raleigh, and Charlotte); central South Carolina (Columbia); and central Georgia (Augusta and Macon). **South** to central Georgia (Macon); central Alabama, rarely (Autaugaville); southern Arkansas (Monticello and Arkadelphia); northeastern Texas (Paris, Commerce, and Dallas); west-central Oklahoma (Fort Reno and Thomas); southern New Mexico (Roswell and Silver City); probably southwestern Texas (Fort Hancock and El Paso); northern Sonora (Moctezuma, Magdalena, and Colonia Indepencia); and northwestern Baja California (El Rosario). **West** to the Pacific coast from northern Baja California (El Rosario) to western Alaska (Frosty Peak, Alaska Peninsula; Nushagak, Hooper Bay, Saint Michael, and Kobuk River). Wandering birds have been collected at Icy Cape and Wainwright on the northwest coast of Alaska several hundred miles north of the northernmost breeding record.

Winter range.—The yellow warbler is found in winter **north** to southern Baja California (La Paz); Jalisco (La Barca); Morelos (Cuernavaca and Yautepec); southern Veracruz (Tlacotalpan); Yucatán (Tunkás); and Quintana Roo (Akumal); occasional or accidental in winter near Brownsville, Tex. **East** to Quintana Roo (Akumal); Honduras (Tela and Ceiba); Nicaragua (Bluefields); Panamá (Almirante and the Canal Zone); Venezuela (Trinidad Island); British Guiana (Georgetown and the Berbice River); Surinam (Paramaribo); Cayenne (Cayenne and Approuague); and northeastern Brazil (Chaves). **South** to northern Brazil (Chaves, and Bôa Vista on the Rio Branco) and central Perú (La Merced). **West** to central western Perú (La Merced); western Ecuador (Guayaquil, Chones, and Esmeraldas); western Colombia (Condoto, Medellín, and Turbo); western Costa Rica (El General, San José, and Bolson); El Salvador (Puerto del Triunfo); western Guatemala (San José and Matzantinango); Chiapas (Huehuetán); Guerrero (Coyuca); Colima (Manzanillo); and southern Baja California (La Paz).

The range as outlined is divided into several subspecies or geographic races. The Newfoundland warbler (*D. p. amnicola*) breeds from central western Alaska south to central British Columbia, central Alberta, Saskatchewan and Manitoba, central Ontario and Quebec northward and east to Newfoundland; the Alaska yellow warbler

(*D. p. rubiginosa*) breeds in the coastal region of southern Alaska; the Rocky Mountain yellow warbler (*D. p. morcomi*) breeds from southern British Columbia and Washington east through the Rocky Mountains south to northern Nevada, northern Utah and northern New Mexico; the California yellow warbler (*D. p. brewsteri*) breeds west of the Sierras in Oregon and California; the Sonora yellow warbler (*D. p. sonorana*) breeds from southeastern California, southern Nevada, and southern New Mexico to northwestern Mexico and western Texas; the eastern yellow warbler (*D. p. aestiva*) breeds from southern Canada east of the Rocky Mountains southward. The Cuban golden warbler (*D. p. gundlachi*) which is resident in Cuba, the Isle of Pines, and adjacent Cays has been found nesting on Bay Key, Fla. The mangrove, or "golden," yellow warbler (*D. p. castaneiceps*) breeds on both coasts of Baja California from about latitude 27° 14′ N. (San Lucas) southward; and on the west coast of Mexico from southern Sonora (Guaymas) south to Nayarit (San Blas). (Apparently it is only slightly migratory, if at all.)

Migration.—Early dates of spring departure are: Peru—Iquitos, March 11. British Guiana—Abary River, March 25. Venezuela—Rancho Grande, April 8. Colombia—Santa Marta Region, May 1. Panamá—Canal Zone, May 12. Costa Rica—San José, May 11. El Salvador—Chilata, April 24. Guatemala—Quiriguá, May 11. Honduras—Tela, May 9. Mexico—Tabasco, Balancán, May 11; Nuevo León, Montemorelos, May 21. Florida—Seven Oaks, May 27. Mississippi—Deer Island, May 25. Louisiana—Chenier au Tigre, May 21. Texas—Kerrville, May 31.

Early dates of spring arrival are: Florida—Pensacola, April 6. Georgia, Athens, April 7. South Carolina—Charleston, April 3. North Carolina—Windsor, April 4. Virginia—Lawrenceville, April 13. District of Columbia—Washington, April 2. Pennsylvania—Wayne, April 4. New York—New York, April 19. Massachusetts—Taunton, April 24. Vermont—Burlington, April 28. Maine—Portland, May 2. New Brunswick—Scotch Lake, May 1. Nova Scotia—Wolfville, May 8. Quebec—East Sherbrooke, May 6. Prince Edward Island—North River, May 6. Newfoundland—St. Anthony, June 5. Louisiana—Avery Island, March 23. Mississippi—Shell Mound, April 1. Arkansas—Tillar, April 5. Kentucky—Eubank, April 12. Indiana—Richmond, April 14. Ohio—Oberlin, April 12. Michigan—Ann Arbor, April 19. Ontario—London, April 20. Missouri—St. Louis, April 15. Iowa—Cedar Rapids, April 20. Wisconsin—Reedsburg—April 27. Minnesota—Minneapolis, April 27. Texas—Victoria, March 28. Oklahoma—Stillwater, April 16. Kansas—Topeka, April 16. Nebraska—Red Cloud, April 21. South Dakota—Faulkton, April 22. Manitoba—Aweme, April 30. Saskatchewan—Regina, May 4. Arizona—Fort Lowell, March 19. New Mexico—Albuquerque, April 24. Utah—Provo, April 25. Colorado—Littleton, April 23. Montana—Fortine, May 1. Alberta—Camrose, May 3. Mackenzie—Simpson, May 21. California—Diablo, March 12. Oregon—Portland, April 17. Washington—Camas, April 5. British Columbia—Comox, April 25; Atlin, May 15.

Late dates of fall departure are: Alaska—Ketchikan, September 6. British Columbia—Atlin, August 26; Chilliwack, September 9. Washington—Destruction Island, September 23. Oregon—Newport, September 18. California—Berkeley, October 10. Alberta—Edmonton, September 1. Montana—Great Falls, September 25. Wyoming—Yellowstone National Park, September 21. Colorado—Fort Morgan, October 2. Arizona—Organ Pipe Cactus National Monument, October 17. Saskatchewan—East End, September 5. Manitoba—Oak Lake, September 18. North Dakota—Fargo, September 19. South Dakota—Aberdeen, September 20. Kansas—Hays, September 23. Texas—Somerset, October 8. Minnesota—Lanesboro, September 10. Wisconsin—Milwaukee, September 20. Iowa—Marshalltown, September 26. Missouri—Bolivar, October 26. Michigan—Grand Rapids, October 8. Ontario—Ottawa, September 29. Ohio—Cleveland, September 30. Illinois—Chicago, September 29. Kentucky—Hickman, September 23. Mississippi—Gulfport, October 20. Louisiana—New Orleans, October 27. Newfoundland—Tompkins, September 9. Quebec—Montreal, September 3. New Brunswick—St. John, September 2. Nova Scotia—Yarmouth, September 11. Maine—Winthrop, September 23. Vermont—St. Johnsbury, September 21. Massachusetts—Stockbridge, October 1. New York—Rochester, October 30. Pennsylvania—Berwyn, October 7. District of Columbia—Washington, October 12. Virginia—Lexington, October 10. South Carolina—Charleston, October 10. Georgia—Milledgeville, October 27. Florida—Fort Myers, October 25.

Early dates of fall arrival are: Louisiana—New Orleans, July 15. Mississippi—Bay St. Louis, July 7. Florida—St. Marks, July 18. Mexico—Sonora, Sáric, July 31; Oaxaca, Tapanatepec, August 20. Honduras—Lancetilla, August 27. El Salvador—Le Unión, August 1. Nicaragua—Bluefields, August 22. Costa Rica—Puerto Limón, August 17. Panamá—Almirante, August 13. Colombia—Bonda, Santa Marta Region, August 27. Venezuela—Cantaura Anzoatique, September 27. British Guiana—Abary River, September 2. Surinam—Paramaribo, August 28.

Banding.—The majority of the banding recoveries indicate the return to the place of banding and give records of longevity. Three birds banded as adults at Wilton, N. Dak., were retrapped at the same station in the following year. One banded at Sioux City, Iowa, on

May 17, 1929, was killed by an auto at the same place June 18, 1932. One banded at Sault Ste. Marie, Mich., on May 30, 1926, was retrapped on May 29, 1929; another banded at the same station, May 20, 1928, was killed by an auto June 28, 1934. A yellow warbler banded at North Eastham, Cape Cod, Mass., on May 28, 1931, was retrapped at the same station May 15, 1932, May 18, 1936, and August 6, 1937.

Casual records.—The yellow warbler has twice been collected in Bermuda: November 23, 1875; and October 14, 1903. It has also been observed near Habana, Cuba, on September 3 and 10, 1939. There are three winter records in South Carolina; it was seen at a feeding station at Summerville in the winter of 1939 and on January 21, 1940; and at Charleston on January 18, 1947.

Egg dates.—California: 110 records, April 16 to July 15; 56 records, May 21 to June 19, indicating the height of the season.

Massachusetts: 113 records, May 19 to June 30; 82 records, May 27 to June 7.

Minnesota: 26 records, May 29 to June 23; 17 records, May 29 to June 8.

New Jersey: 32 records, May 15 to June 24; 24 records, May 26 to June 7.

Utah: 23 records, May 8 to July 16; 12 records, June 6 to 17.

Washington: 21 records, May 28 to June 24; 11 records, June 2 to 7.

Baja California: 11 records, May 8 to June 12; 6 records, May 15 to June 2, indicating the height of the season.

Mexico: 6 records, June 4 to 20 (Harris).

DENDROICA PETECHIA AMNICOLA Batchelder

NEWFOUNDLAND YELLOW WARBLER

HABITS

Based on a series of 14 adult males and 3 adult females from Newfoundland, Charles F. Batchelder (1918) gave the above name to the yellow warblers that breed in that region. After giving a detailed description of the type from Curslet, Newfoundland, he remarks: "When seen in series, the yellow of the under parts is duller, less richly golden, and the chestnut streaks are darker. In comparison with *aestiva*, the female is duskier, less yellowish, throughout the upper parts. * * *

"In general coloring *D. ae. amnicola* shows a certain similarity to *D. ae. rubiginosa*, but it is readily distinguishable from that race by the yellow forehead which, as in *D. ae. aestiva*, contrasts strongly with the green of the back."

Its breeding range extends from Newfoundland to central Alaska, and from Nova Scotia to British Columbia, which includes nearly all of Canada. It migrates through most of the United States, principally through the Mississippi River Basin, and winters in Mexico and possibly South America.

Only a few nesting data are referable to the Newfoundland yellow warbler. Henry Mousley (1926), at Hatley, Quebec, saw a female yellow warbler leaving a large cedar hedge, and says: "Proceeding to the spot from which she came out, I found the nest, which, unlike the usual run of nests of this species, was heavily lined with feathers, instead of plant down * * *. It was nine feet above the ground, in the forks of a small cedar tree."

Roderick MacFarlane (1908) found this warbler abundant in northern Mackenzie, where the nests were "placed on dwarf willows and small scrub pine at a height of a few feet above the ground." Dr. E. W. Nelson (1887) writes:

> This is, perhaps, the most abundant warbler throughout Alaska. It is found everywhere in the wooded interior, on the bushy borders of the water-courses, or frequenting the scattered clumps of stunted alders on the shores of Bering Sea, and the coast of the Arctic about Kotzebue Sound. * * * It breeds to the shores of the Arctic Ocean wherever it can find a willow or alder patch wherein to build its nest and shelter its young. * * * In fall, from the last of July to towards the last of August, they come about the houses and native villages to feast on the fare they find provided abundantly in those localities, until, a little later in the season, a few chilling storms send them trooping away with others of their kind to far distant winter quarters.

Dr. Herbert Brandt (1943) writes:

> The Newfoundland Yellow Warbler was not observed about Hooper Bay, but as soon as I reached the willows near the mouth of the Yukon River I found it common, and also of like distribution at the other stops that I made on the river as far up as Mountain Village. * * *
>
> The nest of the Newfoundland Yellow Warbler in the Yukon delta is placed usually in a small willow from two to six feet above the ground. The foliage in early July is but partly unfolded, for the alders are yet in their golden curls and the willows in their silver catkins, so the nest is rather conspicuous.
>
> The bird chooses a pronged fork usually with not more than three or four shoots, and in this form constructs its beautiful, trim nest, which is made of plant down and inner bark shreds, all circularly woven and firmly rimmed.

Baird, Brewer, and Ridgway (1874) say: "The notes of Mr. Kennicott and the memoranda of Messrs. McFarlane, Ross, and Lockhart attest the extreme abundance of this species in the farthest Arctic regions. In nearly every instance the nests were placed in willows from two to five feet from the ground, and near water. In one instance Mr. Ross found the eggs of this species in the nest of *Turdus swainsoni*, which had either been deserted or the parent killed, as the eggs were in it, and would probably have been hatched by the Warbler with her own."

As evidence of the late migration of this subspecies, Robie W. Tufts writes to me from Nova Scotia: "The latest date of departure which appears to be normal is October 7, 1936, though they generally leave during the second week of September. On November 25, 1929, a female was collected by me at Wolfville. The bird was searching for food very actively and its general behavior was decidedly abnormal. The bird's body showed slight traces of emaciation." Birds that have been recorded in Massachusetts as late as September 30, long after our local breeding birds have left, were probably of this subspecies.

DENDROICA PETECHIA RUBIGINOSA (Pallas)

ALASKA YELLOW WARBLER

HABITS

This subspecies was formerly supposed to range throughout most of Alaska, but its breeding range is now understood to be restricted to the coast region of southern Alaska and British Columbia, from Kodiak Island (the type locality) southward to Vancouver Island. It migrates through California to Mexico and Central America, and probably spends the winter in South America. In El Salvador, according to Dickey and van Rossem (1938), "this race was found only as a fairly common spring migrant through the upper levels of the Arid Lower Tropical. As with *D. p. aestiva* the winter range undoubtedly lies farther to the south. It is notable that *rubiginosa* occurs at somewhat higher elevation than the other three forms and was not found at all in the 'tierra caliente.'" This race has been reported in Kansas and in central Texas, but these birds may have been *amnicola*, which somewhat resembles *rubiginosa* and which had not been accepted at that time.

Ridgway (1902) describes the Alaska yellow warbler as "similar to *D. ae. aestiva*, but slightly smaller and much duller in color. Adult male darker and duller olive-green above, the pileum concolor with the back or else becoming slightly more yellowish on forehead (very rarely distinctly yellowish on forehead and fore part of crown); wing-edgings less conspicuous, mostly yellowish olive-green, sometimes inclining to yellow on greater coverts. Adult female darker and duller olive-greenish above, duller yellow below." He might have added that the chestnut streaks on the breast are narrower than in *aestiva.*

Nothing seems to have been published on the nest and eggs of the Alaska yellow warbler, nor on its habits, all of which probably do not differ materially from those of the species elsewhere in similar environment.

DENDROICA PETECHIA MORCOMI Coale

ROCKY MOUNTAIN YELLOW WARBLER

HABITS

This is another race that was described many years ago by H. K. Coale (1887) but has only recently been accepted by the A.O.U. Coale gave it its scientific name in honor of J. Frean Morcom and called it the western yellow warbler. The following remarks by Dickey and van Rossem (1938) tell the story very well:

> The race of yellow warbler summering in the Great Basin and Rocky Mountain regions of the United States of late years has been generally overlooked and has been synonymized commonly with *aestiva* or, in part, with *brewsteri*. Although not a well differentiated form, its characters are readily apparent in series, and there is no reason why it should not be accorded equal standing with the races currently recognized. The underparts of the males are heavily marked, and in this respect *morcomi* is not distinguishable from *aestiva*. Dorsally, however, *morcomi* is darker and less yellowish green, particularly on the interscapular region. The females are, age for age, more buffy (less yellowish) below and darker and more grayish above than the females of *aestiva*. In comparison with *brewsteri*, *morcomi* (particularly the bill) is larger, and the males are more heavily streaked below. The range of *morcomi* is the Rocky Mountain region of the United States, north to Wyoming and Idaho, west to the eastern slope of the Sierra Nevada, and south (in the western part of its range) to Mammoth, Mono County, California. We have not seen material from the southern Rocky Mountains; so we cannot state the southern limits in that region.

They call it a "common spring and fall migrant and winter visitant in the lowlands," of El Salvador. "Dates of arrival and departure are August 1 and April 9."

Angus M. Woodbury has sent me a copy of the manuscript for "The Birds of Utah," by Woodbury, Cottam, and Sugden, from which I infer that the haunts, nesting, and other habits of the "western yellow warbler," as they call it, do not differ materially from those of the well-known eastern bird. They say of its status in Utah: "This yellow warbler is a common summer resident from early May to late August, the vanguard sometimes reaching here in late April and stragglers sometimes lingering into September, the latest record being September 23. It is primarily a bird of the riparian growths along water edges, either of streams, ponds or lakes or irrigated areas, particularly of the valleys and lower canyons, but occurs higher in the canyons in suitable habitat up to at least 8,000 or 9,000 feet. It does not seem to be attracted to large trees such as cottonwoods, but seems to prefer the more leafy shrubbery and small trees of developmental stages in ecological succession. In migration, it sometimes leaves this niche and may occasionally be found elsewhere. * * *

"In nesting, it is usually found in a bush, chaparral or small tree stratum, seldom going to the ground or to the tops of trees. Its nests are compactly woven cups generally placed from 3 to 10 feet above ground, sometimes 15 feet, in rosebushes, willows, choke cherries, hawk-berries, oaks, young cottonwood or boxelder trees, usually within a short distance of the water's edge. The nest is usually composed of gray plant fibers, bark shreds or grasses and is usually lined with some downy substance such as cottonwood or willow cotton or hair."

DENDROICA PETECHIA BREWSTERI Grinnell

CALIFORNIA YELLOW WARBLER

HABITS

The 1931 A.O.U. Check-List gives the breeding range of this subspecies as the "Pacific coast strip from western Washington south through Oregon and California, west of the Great Basin and southeastern deserts to about lat. 30° in Lower California." It intergrades with *rubiginosa* on the north and with *morcomi* to the eastward, but exact boundaries are difficult to define. It seems to range well up into the mountains, for James B. Dixon tells me that he has found it nesting in Mono County, Calif., at altitudes of 6,500 to 9,200 feet.

Dr. Joseph Grinnell (1903) in an interesting study of western yellow warblers, bestowed the above name on the California bird, for which he gives the following subspecific characters: "Resembling *Dendroica aestiva aestiva*, from which it differs in smaller size, paler (or less brightly yellow) coloration, and, in the male, narrower streaking on under surface; differs from *Dendroica aestiva rubiginosa* in much smaller size and yellower coloration, and from *Dendroica aestiva sonorana* in smaller size and much darker coloration."

Spring.—Both *rubiginosa* and *brewsteri* occur in California and in Washington on migrations. As it is difficult to distinguish the two forms in life, some of the following remarks may refer to either or both of these two subspecies. Mrs. Amelia S. Allen writes to me that this species "is the latest of the warblers to arrive in the San Francisco Bay region for the breeding season. Sometimes they are here by April 8, but the average date is about April 18. At Lake Tahoe, the first week of June, breeding pairs were settled in the willows and migrants on their way farther north were migrating through."

Samuel F. Rathbun says in his Washington notes: "Our experience with this species, based on many years of observation, is that the birds in the spring migration progress northward in a series of what may be called waves. Invariably the first noted will be one or two individuals, and these are heard for a short time only and evidently move on. Then there is a break of a day or so before the next are heard, a larger number. A period of a day, or perhaps two or three, may again elapse before the main body of birds arrive and they are heard on all sides.

Common in and about the city at this period, it haunts the shade trees lining the streets and the fruit trees in the gardens, but is not at all partial to the outlying sections, except in the more cultivated areas and the orchards. It is essentially a bird of the older settled districts, wherever fruit trees and deciduous trees may abound."

For May 6, 1924, he remarks, "These warblers drifted by all day, in ones and twos or threes, straggling, but, although seemingly widely separated, always within hearing distance of each other. At times there will be a break when apparently none are passing, then in the distance the song will be heard again, soon growing louder, as the bird draws nearer, following in the wake of others that have preceded him, his song in turn growing fainter in the distance after he has passed."

Nesting.—The summer haunts and nesting habits of the California yellow warbler are generally similar to those of the eastern bird. Grinnell and Storer (1924) write:

> Yellow warblers nest abundantly on the floor of Yosemite Valley. Some of the nests are in growths close to water, whereas others are located in brush tangles or other rank growths back some distance from the streams. A nest found June 7, 1915, may be taken as fairly typical. It was 52 inches above the ground in the crotch of a forking stem of a chokecherry which grew in a clump of the same plant, and was shaded by a black oak. As usual it was higher than wide outside, being 3½ inches in height by 3 to 3¼ inches in diameter. The cup-like cavity was 1¾ inches across at the top and the same in depth at the center. Shreds of bark and flat plant fibers were the principal materials used in construction, the lining being of horsehair and a few feathers.

One nest was "4 feet above the ground in a mountain lilac (*Ceanothus integerrimus*)," and another "was placed about 15 feet above the ground in a small pine tree growing at the margin of a pond. It rested on the next to the topmost whorl of branches and one side was against the slender trunk of the tree."

In the Lassen Peak region, Grinnell, Dixon, and Linsdale (1930) report four nests in willows, one in a wax-berry (*Symphoricarpos*), one in a snowbush, and one fastened between stems of rose and willow at the edge of a clump of rose.

Eggs.—Three or four eggs seem to constitute the commonest set for the California yellow warbler. These are hardly distinguishable from those of the eastern bird, though they average, perhaps, more heavily marked. The measurements of 40 eggs average 16.6 by 12.4 millimeters; the eggs showing the four extremes measure 18.3 by 13.5, 17.8 by 15.0, 14.7 by 12.2, and 16.3 by 11.4 (Harris).

Food.—Prof. F. E. L. Beal (1907) analyzed the contents of 98 stomachs of California yellow warblers, and found that the animal matter amounts to 97 percent of the food, consisting wholly of insects and a few spiders.

> The largest item is Hymenoptera, which amounts to over 30 percent, almost half of which are ants. The remainder are small bees and wasps, some of

which are probably parasitic species, though none were positively identified. * * * Caterpillars, with a few moths, aggregate over 18 percent.

Beetles form nearly 16 percent of the diet, and embrace about a dozen families, of which the only useful one is that of the ladybirds (*Coccinellidae*), which are eaten to a small extent. The great bulk of the beetle food consists of small leaf-beetles (*Chrysomelidae*), with some weevils and several others. One stomach contained the remains of 52 specimens of *Notoxus alamedae*, a small beetle living on trees. Bugs (Hemiptera) constitute over 19 percent of the food, and are eaten regularly every month. Most of them consist of leaf-hoppers (Jassidae) and other active forms, but the black olive scale appeared in a number of stomachs. Plant-lice were not positively identified, but some stomachs contained a pasty mass, which was probably made up of these insects in an advanced stage of digestion.

Flies seem to be acceptable to the summer warbler; they are eaten to the extent of nearly 9 percent. Some of them are of the family of the house fly, others are long-legged tipulids, but the greater number were the smaller species commonly known as gnats. A few small soft-bodied Orthoptera (tree-crickets), a dragon-fly, and a few remains not identified, in all about 5 percent, made up the rest of the animal food.

Only about 2½ percent of the food was vegetable matter, made up mainly of fruit pulp in a single stomach, one or two seeds and rubbish.

Rathbun (MS.) says that this warbler "shows some partiality for feeding on aphids, for we have many times watched it in an orchard carefully scanning the leaves on a tree for this insect."

All other phases of the life histories of this and the following two subspecies do not seem to differ materially from those of the eastern yellow warbler and need not be repeated here.

Fall.—According to Rathbun's notes, all the resident, breeding yellow warblers have departed from Washington "by the latter part of August, and in some seasons we have not heard the bird after the twenty-fifth; it is one of the few species that sing more or less during all of its sojourn here, and its song in late summer is almost as good as on its arrival in the spring. A break in the movement south of this species seems to occur about August 20 to 25. Then, early in September, the notes of the yellow warbler begin to be heard again. We have the idea that these may be of the Alaska yellow warbler."

Mrs. Allen writes to me from Berkeley, Calif.: "Breeding birds leave the bay region in late July or early August; migrants from farther north begin to go through in September; the latest date on which I have seen them is October 16, 1920. I usually see them in the shade trees along the streets or in the woods when they come to bathe in my bird pool. But I have two records which show them in very different situations: September 18, 1933, on a hill slope that had been recently burnt over, a group of these warblers with horned larks and Savannah sparrows; and on September 25, 1941, at Point Reyes lighthouse, hunting for food in the low, dry lupines just inside the rocky point. One could not help wondering if they had just come to a landing place after a long flight over the ocean. They were in immature plumage."

According to the 1931 Check-List, the California yellow warbler "migrates through eastern California, Arizona, and Lower California; winters sparsely in the Cape District of Lower California and south to Guatemala, Nicaragua, and Costa Rica."

Winter.—Dickey and van Rossem (1938) record this warbler as a "winter visitant and spring migrant in the Arid Lower Tropical Zone," in El Salvador. "The small Pacific coast race, *brewsterii*, is apparently relatively the least common of the four forms found in El Salvador; at any rate, the small number of specimens taken indicates that this is the case. Yellow warblers were common in January at Puerto del Triunfo and in February at Rio San Miguel, but unfortunately only one specimen was taken at each place. Whether all of these winter birds were *brewsteri* and *morcomi* is problematical."

DENDROICA PETECHIA SONORANA Brewster

SONORA YELLOW WARBLER

HABITS

This is the palest of all the yellow warblers, one of the many pale races of the southwestern desert regions. Its breeding range extends from southeastern California, southern Utah, Arizona, and New Mexico to central western Texas, Sonora, and Chihuahua; and it winters from Mexico southward to Guatemala, Nicaragua, and Costa Rica.

It is best described by Ridgway (1902) as "similar to *D. æ. aestiva*, but much paler; adult male lighter and much more yellowish olive-green above, the back frequently (usually?) streaked with chestnut, pileum usually wholly clear yellow, lower rump and upper tail-coverts yellow, faintly streaked with olive-greenish; wing edgings all yellow; under parts lighter yellow than in *D. æ. aestiva*, and with chest and sides much more narrowly (often faintly) streaked with chestnut; adult female conspicuously paler than in *D. æ. aestiva*, the upper parts often largely pale grayish, the under parts usually very pale buffy yellow."

Woodbury, Cottam, and Sugden (MS.) say of its status in southern Utah: "This race of yellow warbler is a breeder of the streamside fringes of willows, tamarix, and brush of various kinds along the San Juan and lower Colorado Rivers. It undoubtedly extends up the Colorado above the mouth of the San Juan, but how far it extends before yielding to *morcomi* has not been determined. Data available are not sufficient to determine its nesting or migration dates or the length of its stay in Utah."

Swarth (1914) calls it "a common summer visitant in southern and western Arizona, apparently confined almost entirely to the Lower

Sonoran river valleys, the Colorado and the Gila, with their tributaries. * * * I know of no breeding record of a yellow warbler from any point in Arizona north of the Mogollon Divide." Mrs. Bailey (1928) says that "the lower Rio Grande in New Mexico apparently marks the most northern extension of the range of the Sonora Yellow Warbler. It is a common breeder at Mesilla," which is in the southwestern part of the State.

We found the Sonora yellow warbler breeding commonly in the San Pedro Valley, near Fairbank, Ariz., and found several nests in a row of willows along an irrigation ditch. The nests, from 12 to 15 feet above the ground in slender trees, were not very different from those of the eastern bird, being made mainly of willow cotton interwoven with fine strips of inner bark, fine grasses, and plant fibers.

The eggs do not differ greatly from those of the species elsewhere, though what few I have seen are more faintly and finely speckled. The measurements of 40 eggs average 16.9 by 12.8 millimeters; the eggs showing the four extremes measure **18.4** by 13.1, 17.0 by **13.6**, **14.9** by 12.5, and 17.8 by **11.4** millimeters (Harris).

DENDROICA PETECHIA GUNDLACHI Baird

CUBAN YELLOW WARBLER

HABITS

The Cuban yellow warbler was originally described by Baird (1864) as a full species but is now regarded as a subspecies of *Dendroica petechia*. Ridgway (1902) describes it as "similar to *D. p. petechia*, but duller in color; adult male with upper parts much darker olive-green, the pileum usually concolor with the back, sometimes slightly more yellowish, very rarely tinged with orange-ochraceous, and wing-edgings less purely yellow; adult female usually duller in color than in *D. p. petechia*, often grayish olive-green, or even largely gray, above, and dull whitish, merely tinged here and there with yellow, beneath."

Until recently, its range has been supposed to include only Cuba and Isle of Pines. Dr. Barbour (1923) says of its habits: "The Mangrove Canary, as the Cuban Yellow Warbler is called, is abundant wherever there are heavy high mangroves about the coast. I have found it abundant in eastern and western Cuba, and on the Isle of Pines as well. Gundlach reports it nesting in March. I incline to believe that May is more usual; and then the nest of grass, small feathers and woolly down, is placed in a fork on some horizontal mangrove limb. The whole life of the species is passed in the mangrove forests."

Referring to the Isle of Pines, W. E. C. Todd (1916) writes: "This is a bird of the mangroves, to which it is apparently exclusively confined. It is accordingly most numerous along the coast and about the islands of Siguanea Bay, where the mangroves are so constant and pronounced a feature. Mr. Read has observed it along the Pine River also, but it is apparently a rare bird in the northern part of the island, judging from the dearth of records, and, indeed, it cannot be called a common bird in any locality as yet visited. Two nests were found, both in mangroves within a few feet of the water, during the third week in April, but as yet without eggs."

More recently, this warbler has been found breeding on some of the lower Florida Keys. Earle R. Greene (1942) writes:

> While exploring one of the Bay Keys in the Great White Heron National Wildlife Refuge off Key West, Florida, on June 15, 1941, with Roger Tory Peterson of the National Audubon Society, a male warbler, in full song, was located. * * * On June 26, the writer located it again on the same key, and on the 28th the male, female and nest were found. The last was in the top part of a red-mangrove tree (*Rhizophora mangle*) and was composed of seaweed and feathers; it contained one egg, white with brownish markings chiefly about the larger end. On July 10, the egg was found broken, apparently jabbed, possibly by a Red-wing nesting nearby. On July 16, the male bird was collected, and on the 30th the female.

Later (1944) he says: "Since then, a male and female were seen on June 16, 1942, on these same keys, and on July 14, 1942, an adult female was noted on the same keys. On August 6, 1942, a male and female, as well as an immature bird, being fed by an adult, were found on Big Mullet Key in the Key West Refuge, which is several miles from the Bay Keys. A letter received from Mrs. Frances Hames states that she found one bird, in song, on one of the Bay Keys on May 30, 1943. I consider it, therefore, a regular nester on certain keys in that area. Additional investigations may determine it as a common breeder."

DENDROICA PETECHIA CASTANEICEPS Ridgway

MANGROVE YELLOW WARBLER

HABITS

Along both coasts of Baja California southward from about latitude 27° N., and along the Pacific coast of Mexico from Sinaloa to Guatemala, where that curious tree, the red mangrove (*Rhizophora mangle*), bathes its feet in salt water along the shores of bays, estuaries, and tidal creeks, this handsome yellow warbler makes its permanent home. The red mangrove extends its growth on these muddy shores by sending its curving branches outward and downward to take root again in the mud, thus forming an almost impenetrable tangle of roots and branches in an ever-widening band extending outward from the dry land. Its dense, dark foliage forms a low, gloomy forest of branches in which this well-named warbler finds a secure retreat and to which it is almost exclusively confined. It has not always been easy to obtain in these tangles, for Brewster (1902) says that—

> during January, February, and a part of March, 1887, Mr. Frazer repeatedly visited all the mangrove thickets that he could find near La Paz, and made every effort to secure a good series of these Warblers, but he took only eight in all and did not shoot more than a pair in any one day. He notes the bird as "rare," but adds that "its numbers increased slightly in March." It cannot be very numerous here at any time, for the total area covered by its favorite mangroves is very limited. Indeed, the place where most of his specimens were obtained "comprises only about two acres, through which winds a small creek, fordable at low tide; but at high water everything is submerged up to the lower branches of the mangroves. I always found the birds working near the surface of the water on the stems of the mangroves or hopping about on the mud, but the males resorted to the tops of the bushes to sing. Their notes are similar in general character to those of the Yellow Warbler."

W. W. Brown was evidently more successful a little later in the season, for, in that same locality in May and June, he collected a large series of these beautiful birds for several American collections, mainly Col. John E. Thayer's. He wrote to Colonel Thayer (1909):

> I found the Mangrove Warbler a rare bird, but my previous experience with this species in Panama, the Pearl Islands, and in Yucatan is what made me successful. I learned its song and alarm note in 1893. The first morning I went into the mangrove swamps of La Paz I whistled the song of the Yucatan species and the birds answered me; this is the secret of my success, for the species is very secretive in its habits. I found it so difficult to get that I offered fifty cents apiece to the duck hunters and others, including the local taxidermist, but they all failed to get it! By covering eight miles of territory I generally managed to get four or five. Sometimes when I shot one it would fall in the mangroves, with a tide running fast. Under such conditions it generally took a long time to find it, and a great deal of cutting with the machete.

Referring to the form found in El Salvador, Dickey and van Rossem (1938) remark: "To add to the difficulties in the path of the collector, the brown and yellow plumage of the males blends perfectly with the dead or dying mangrove leaves which are kept in continual motion by the sea breeze."

Nesting.—Brown sent Colonel Thayer (1909) three nests of the mangrove warbler, only one of which contained a set of three eggs. Of this he says: "The nest with eggs is made (and the others resemble it very much) of light green fern down, cobwebs, and light-colored dried grasses, with a few white feathers plastered on the outside. It is beautifully lined with feathers. It is not so perfectly shaped or so well made as the Yellow Warbler's nest."

There are now six beautiful nests of this warbler in the Thayer collection in Cambridge, all collected by Brown near La Paz on dates ranging from May 15 to June 2; all were placed in the red mangroves, either on horizontal branches, mostly near the ends, or in forks; the heights from the ground or water varied from 2 feet to 10 feet. The largest and handsomest nest was 10 feet up on a horizontal branch; it is a very neat, compactly woven cup, made of soft, fine, light buff plant fibers, mixed with plant down, green moss that looks like down (probably the "light green fern down" referred to above or *algae*), a few gray lichens and many whitish flower clusters; it is lined with very fine fibers, apparently from the mangroves, and plenty of feathers; it measures externally 3 inches in diameter and 2½ inches in height; the inner diameter at the top of the in-curved rim is 1¾ inches and the cup is near 2 inches deep. The smallest nest measures only 2¼ inches in outside diameter. The shallowest nest is only 1½ inches high and 1¼ deep inside.

These nests are all works of art and quite distinctive; all the materials are smoothly and compactly felted, being tightly plastered together, as if glued on when wet. The light color and compactness suggest certain hummingbirds' nests. Most of the nests seem small for the size of the birds.

Eggs.—Three eggs seems to form the usual set for the mangrove warbler; in the Thayer series there are five sets of three and one set of two. Ed. N. Harrison (MS.) says that "it seems that one egg is a set as often as two." Most of the eggs in this series are ovate, but some are short ovate; they have only a very slight gloss. They are white or creamy white, speckled, spotted or blotched with shades of "mummy brown," "bone brown," "Prout's brown," or "clove brown," with undertones of "light mouse gray," "deep mouse gray," "Quaker drab," or "drab-gray." The browns are frequently so dark as to appear almost black, but some eggs are spotted with lighter shades, such as "cinnamon brown" and "snuff brown." On the more lightly marked types the most prominent markings are the grays, with only a few scattered brown spots. Often a loose wreath is formed around the large end, where the spots are usually concentrated.

The measurements of 32 eggs average 17.9 by 13.4 millimeters; the eggs showing the four extremes measure **19.5** by 13.2, 17.9 by **14.6**, **17.0** by 13.2, and 18.3 by **12.9** millimeters (Harris).

Plumages.—Although I have examined a large series of mangrove warblers, I have seen no downy young and no summer birds in juvenal plumage. But Dr. Chapman (1907) describes the young female as "above grayish olive-green, rump brighter; tail blackish, externally greenish, webs of all but central narrowly margined with yellow; wings and their coverts blackish, quills margined, coverts tipped with dull greenish; below whitish more or less washed or obscurely streaked with yellow, the under tail-coverts pale yellow."

Young males in the fall are much like adult females, but brighter in color and often with traces of chestnut on the head. Apparently young males wear this femalelike plumage all winter; young males in March show a variable amount of chestnut on the head and throat, and show further progress toward maturity during April, May, and June, indicating a first prenuptial molt. A specimen described by Brewster (1902) is apparently undergoing this molt. "It has the head dull chestnut, very pale and mixed with whitish on the throat, mottled with greenish on the crown; the jugulum, sides of the neck and the middle of the breast *white* with occasional small patches or single feathers of a pale yellow color and numerous fine, chestnut-rufous streaks on the breast; the remainder of the under parts pale primrose yellow mixed with whitish. The back, wings, and tail are nearly as in the adult female. The upper mandible is of the usual dusky horn color, but the basal half of the lower mandible of a pale flesh color. The plumage, generally, has a worn and faded appearance."

This would seem to indicate that the first prenuptial molt is quite extensive, and that young birds become nearly adult after their molt. Adults probably have a complete postnuptial molt sometimes during the summer, but the following descriptions indicate that the prenuptial molt of adults is less extensive. Ridgway (1885) describes the type male, taken December 16, 1882, as follows: "Head rich chestnut, lighter or more rufous on the throat. Upper parts olive-green, the wings dusky, with broad greenish yellow edgings; outer webs of rectrices dusky, edged with yellowish olive-green, the inner webs chiefly primrose-yellow. Lower parts bright gamboge-yellow, the jugulum and breast with a few very indistinct and mostly concealed streaks of chestnut-rufous." And of an adult female, taken December 29, 1882, he says: "Above grayish olive-green; wings grayish dusky, the feathers edged with olive-grayish; rectrices dusky, outer webs edged with olive-green, the inner with primrose yellow. Lower parts dull pale olive-yellowish."

From Dr. Chapman's (1907) descriptions of spring adults it appears that there is very little seasonal change. Male: "Head all around and throat reddish chestnut; back yellow olive-green, the rump brighter; inner webs of all but central tail feathers largely yellow; wings black margined with yellow; underparts, except throat, rich yellow faintly streaked with reddish brown." Female: "Above olive green, much darker and greener than ♂; tail black the two outer feathers with large yellow patches on the inner web near the tip; wings black margined with greenish yellow; below uniform pale, dull yellow."

Laurence M. Huey (1927), referring to the bird life of San Ignacio and Pond Lagoons, on the west coast of Baja California, states that mangrove warblers were found there—

> in isolated pairs and gave evidence of early nesting by their singing and by the condition of the sex organs of the specimens collected. This warbler was one of the most interesting species observed. The song of the male was usually delivered from a hidden position amid the dense mangroves, though occasionally the bird was seen perched on a dry twig projecting above the level tops of the thicket. The song was pleasing in tone, and of good volume, suggesting that of the Yellow Warbler, but less shrill. Unlike the song of the Yellow Warbler, it was given with a steady rising inflection. The alarm note is a sharp chirp. audible at some distance even during a brisk wind. This note is uttered at intervals and always in the same tone, much as are the chipping notes of the Orange-crowned Warblers. In searching for food, Mangrove Warblers resemble others of the genus *Dendroica* in their habit of searching each leaf and stem with most careful scrutiny. At times, however, they were seen to launch forth into the air, in true "flycatcher" fashion, after small insects. These aerial sallies were seldom for a distance of over 10 feet, and the bird nearly always returned to the same perch from which it started.

Enemies.—The following remarks by Dickey and van Rossem (1938) about the El Salvador race of this species are of interest:

> As the entire lives of these birds are spent in an environment which renders them immune from attack by the great majority of the predators which harass species inhabiting the land forest, one is at first inclined to be surprised at their relative scarcity. Raccoons (*Procyon*) are extremely common in the mangroves and were often found prowling through the branches at night. They, as well as carnivorous iguanas, undoubtedly take toll of many nests, but aside from these two it is difficult to conjecture what natural enemy operates to limit the mangrove warbler population. Certainly no "saturation point" has been reached, for pairs may be separated by as much as a mile even in the areas which appear most favorable.

DENDROICA MAGNOLIA (Wilson)

MAGNOLIA WARBLER

PLATES 26–28

HABITS

Wilson secured only two specimens of this pretty warbler, one of which was shot among some magnolia trees near Fort Adams, Miss. He gave it the scientific name *Sylvia magnolia* but called it the black and yellow warbler. This stood for many years as the common name. Nuttall, who had seen it only occasionally in Massachusetts, regarded it as rare. Audubon, on the other hand, found it quite common and even abundant in several places, as we now know it to be. His lively plate of this beautiful bird, one of his best, has always been a favorite of mine; and it seems to me that in the magnolia warbler, more than in any one of the many beautiful species of American wood warblers, are best combined daintiness of attire with pleasing combinations and contrasts of often brilliant colors. Particularly are these qualities apparent when this warbler is seen amongst the dark green firs and spruces of its summer home, where its brilliant array of colors are displayed to advantage as it flits about, sometimes within a few feet of us.

Spring.—From their winter quarters in Mexico and Central America, some magnolia warblers migrate straight across the Gulf of Mexico to the Gulf coast between Louisiana and western Florida; they seem to be accidental in Cuba and very rare anywhere in Florida. Another migration, probably of some importance, occurs along the coast of Texas from the mouth of the Rio Grande to Louisiana; I saw a few magnolia warblers in the great migration wave noted on an island in Galveston Bay on May 4, 1923. Professor Cooke (1904) remarks: "The dates of arrival of the magnolia warbler in spring furnish the best evidence yet available in support of the theory that birds migrating across the Gulf of Mexico do not always alight as soon as they reach the shore. The species is a common spring migrant from the Mississippi River to the Atlantic, between latitudes 37° and 39°. South of this district it becomes less and less common, except in the mountains, until in the Gulf States it is rare." It is significant that the earliest date of arrival at Atlanta, Ga., is the same as at the lower Rio Grande in Texas, April 20.

William Brewster (1877) writes:

> The Black-and-Yellow Warbler arrives in Massachusetts from the South about the 15th of May. During the next two or three weeks they are abundant everywhere in congenial localities. Willow thickets near streams, ponds, and other damp places, suit them best, but it is also not unusual to find many in the upland woods, especially where young pines or other evergreens grow thickly. Their food at this season is exclusively insects, the larger part consisting of the numerous species of *Diptera*. The males sing freely, especially on warm bright mornings. They associate indifferently with all the migrating warblers, but not unfrequently I have found large flocks composed entirely of members of their own species, and in this way have seen at least fifty individuals collected in one small tract of woodland. By the first of June all excepting a few stragglers have left.

On its migration as well as on its breeding grounds the magnolia warbler seems to avoid the taller treetops and to prefer the lower levels in the forests and in the thickets along the borders of woodlands; it is sometimes seen in garden shrubbery and in orchards, where it adds a brilliant touch of color to the blossoming fruit trees. When it reaches its breeding haunts it prefers low hemlock thickets, or more especially, where these can be found, the dense thickets of small spruces or balsam firs that spring up thickly in old clearings, or grow profusely along the more open woodland paths; the density of the forest depths seems to be avoided in favor of the more open spaces.

In Allegany Park, N. Y., according to Aretas A. Saunders (1938); "Magnolia warblers seem to have territory and a definite singing location, but I have seen no animosity toward each other or other species of warblers, such as the black-throated green and blackburnian, birds that have very similar habits and live in the same habitat and sometimes sing regularly in the same tree. * * * Territories are evidently vertical as well as horizontal, that is measured in volume rather than area, so that a clump of big hemlocks furnishes space for several pairs and several species of hemlock-loving warblers."

Courtship.—William H. Moore (1904) says: "During the mating season the males are pugnacious little fellows, and many fights do rivals have. They attack each other with much fierceness, seizing hold with their beaks, and hitting with half-opened wings they sprawl about on the ground, until thoroughly overcome. When pressing his suit to the female of his choice, the male displays his colors to great advantage, as they show in fine contrast among the bright green foliage of the trees."

Nesting.—All the 14 or more nests that I have seen, in Maine, New Brunswick, Quebec, and Newfoundland, have been in small spruces or balsam firs growing in old clearings, in reclaimed boggy pastures, or along the edges of coniferous woods. These little trees were often less than 6 feet high and generally stood in dense thickets. The lowest nest I find recorded in my notes was only 12 inches above the ground in a tiny fir, and the highest was 8 feet up in a slender balsam in a thick clump of these trees in rather open woods; more nests were below 5 feet than above it. The nests usually rested on horizontal branches or twigs and against the trunk but in a few cases they were placed a few inches or a foot out on a branch.

Similar nesting habits seem to be characteristic of the magnolia warbler in other parts of northern New England, Nova Scotia, and southern Canada according to information received from others; and most of the nests have been placed at similar low levels, though Mr. Brewster (1938) found one near Lake Umbagog that was 25 feet from the ground. In this northeastern region an occasional nest has been found in a cedar, a larch, or a small hemlock, but at a height usually less than 5 feet.

In New York and Pennsylvania hemlock seems to be the favorite tree, and the magnolia warbler more often places its nest at a higher level and well out toward the end of a horizontal branch, where it is usually shaded and sometimes well concealed in dense foliage. Verdi Burtch, of Branchport, N. Y., wrote to Dr. Chapman (1907) that he found nests "in hemlocks usually on a horizontal limb from eight to twenty feet up and over an opening in the woods. Several nests were found in the top of little hemlock saplings from one to five feet from the ground. One nest was found by Mr. C. F. Stone in a birch sapling, this being the only instance to my knowledge of its nesting in a tree other than a hemlock." He has sent me a photograph of a nest in a wild blackberry bush.

T. E. McMullen has given me the data for 14 nests of the magnolia warbler found in the Pocono Mountains, Pa.; 10 of these were located in hemlocks from 30 inches to 30 feet above the ground and from 6 to 12 feet out on the branches; one nest was 30 feet up and one 18, but the others were all less than 10 from the ground. The other 4 nests were in rhododendrons, in woods, or along the banks of creeks, and were from 2 to 3 feet up.

Edward A. Preble (Todd, 1940) says that "all but one of more than fifty nests of this warbler that R. B. Simpson has examined near Warren [Pa.] were placed in hemlocks. One nest was at the exceptional height of thirty-five feet; another was only a foot from the ground in some low hemlock brush." Mr. Simpson's other nest was in a witch-hazel, and Mr. Saunders reported one in a pin cherry, both under hemlocks.

The magnolia warbler is a poor nest builder; its nests are apparently carelessly built and are very flimsy affairs, much like poorly built nests of the chipping sparrow; and they are usually insecurely attached to their supports. Brewster (1877) gives the following good description of a typical nest: "The framework is wrought somewhat loosely of fine twigs, those of the hemlock being apparently preferred. Next comes a layer of coarse grass or dry weed-stalks; while the interior is lined invariably with fine black roots, which closely resemble horse-hairs. In an examination of more than thirty examples I have found not one in which these black roots were not used. One specimen has, indeed, a few *real* horse-hairs in the lining, but the roots predominate. This uniform coal-black lining shows in strong contrast with the lighter aspect of the outer surface of the nest."

Miss Cordelia J. Stanwood, of Ellsworth, Maine, who has sent me some elaborate notes on the magnolia warbler, gives me this description of one of her best nests: "In this some hay and the fine tips of cinquefoil served as a foundation, but the greater part of the nest consisted of a fine black, vegetable fibre, resembling horsehair. So much of this hairlike material was used that, when the rim was frescoed with down from the willow pod, a person looking at the dainty abode in its setting of fir twigs could see nothing but the jet-black lining and the fluffy, silvery plant-down around the throat of the nest. The structure was partly pensile, being bound with spiders' silk to the two branches at right angles to the main stem.

"The front part of the base rested on the branches beneath. It was placed in a small fir, 2 feet from the ground, surrounded by a growth of fir and gray birches. * * * The nests were about 2 inches wide at the top on the inside and 1¼ deep. The wall at the top was ¾ inch thick."

A series of eight nests now before me vary considerably in size, compactness, manner of construction, and in the materials used. The largest two measure 4 inches and 3¾ inches, respectively, in outside diameter, and the smallest ones measure from 2¾ to 3 inches. The inner diameter seems to be more constant, varying from 1¾ to 2 inches. All of my nests are shallow, hardly more than an inch deep internally in most cases. Some of them are fairly well made, but most of them are very flimsy and more or less transparent. The neatest nests have the sides and rims well built up with dry grass or weed stems of varying degrees of fineness and density. In some there is no grass, but the sides are well made of the very finest hemlock or larch twigs interwoven with fine, red, fruiting stems of mosses and many fine, black rootlets; they are often slightly decorated or camouflaged with a few weed blossoms or bits of wool or plant down. The lining of black rootlets is present in these and in all other nests of the magnolia warbler that I have seen; it seems to be characteristic of the species and will distinguish the nests from those of other warblers. This jet-black lining forms a fine background against which the handsome eggs are shown in striking contrast.

Miss Stanwood gives in her notes the following account of nest building: "The birds fly with much jolly chattering through the trees and examine any nesting sites that appear desirable. The dainty female, after fitting her little body into many spaces among the twigs, finds one that is entirely adapted to her prospective domicile, and the birds proceed to fashion a basketlike frame of long, fine potentilla or cinquefoil runners, or culms of fine hay. These they fasten to the twigs and needles around the selected space with spiders' web, or tent caterpillar silk, leaving the long ends free. Around the top of the basketlike frame on the interior is laid a culm of hay in the form of an imperfect circle, which is secured to the frame with spiders' silk; many of the long ends are then turned down within, or crumpled into the space for the foundation of the superstructure. In the frame is fashioned the cradle, which is symmetrical and cup-shaped on the inside, but may be formed like the bowl of a spoon on the outside, according to the space which it is designed to fill. The preferred lining materials appear to be a jet-black, hairlike vegetable fibre, and horsehair, but on occasion, the dull orange setae of the birdwheat moss, or the brown fruit stems of maples are used for this purpose.

"Both twittering birds bring the materials while it is damp, if possible, and place it, but being very timid, they work little while an observer is near. At such times the birds come silently, one at a time, deposit the bit of cinquefoil or hairlike fibre hurriedly, the female who is oftentimes less timid than the male, doing most of the modelling, turning around and around in the tiny dwelling and shaping it with her breast. Two birds that I timed carefully spent 4 days building their habitation, and another pair 6 days in doing the same work. The amount of time occupied by the task is determined by the abundance or scarcity of materials and the weather; continuous, heavy, cold and retard the work greatly."

Eggs.—Four eggs almost always form a full set for the magnolia warbler, but sometimes there are only three and occasionally five. They vary in shape from ovate to short ovate, or rarely to elongate ovate, and are only slightly glossy. The ground color is white or creamy white and in some instances greenish white. Their markings vary considerably, some being very lightly speckled, while others are boldly spotted, blotched or clouded with "buffy brown," "cinnamon-brown," "Mars brown," "Prout's brown," "mummy brown," "Brussels brown," "chestnut," "auburn," or "tawny-olive," with occasional scrawls of "bay" or black, and with undertones of "vinaceous-drab," "deep brownish drab," or "Quaker drab." There is a tendency for the markings to be concentrated at the large end, where they often form a wreath, or sometimes a solid cap. Many interesting effects are found on the boldly marked eggs, where the large brown blotches are superimposed on the drab undertones. The measurements of 50 eggs average 16.3 by 12.3 millimeters; the eggs showing the four extremes measure 17.9 by 13.2, 15.0 by 12.0, and 15.8 by 11.6 millimeters (Harris).

Young.—The period of incubation for the magnolia warbler is said, by different observers, to be 11, 12, or 13 days, and it is evidently performed by the female only. Miss Stanwood tells me that incubation sometimes begins after the second egg is laid. One egg is laid each day until the set is complete. The young remain in the nest from 8 to 10 days, usually the latter. The eyes of the young are opening on the third or fourth day. On the sixth day, the feathers are breaking the sheaths, and by the eighth or ninth day the young are well feathered. The female does all the brooding of the young, of which Miss Stanwood writes in her notes:

"At first the mother bird covered the young much of the time, as the infant birds were fragile and the weather was cold and damp. Every few minutes the brooding bird moved back on the nest far enough to feed the nestlings regurgitated or digested food, and to cleanse the nest of biting pests such as ants, which might endanger the lives of the baby birds. The father bird sang gaily, far away and near at hand, throughout the long summer day. When he came to the nest with food, he flirted his tail, fluttered his wings, quivered all over and twittered very prettily to his mate, who responded in like manner.

"He presented his first tender moths and juicy caterpillars to the mother bird, who ate part of them, but the remainder she crushed and mixed with digestive juices in her mouth and placed well down the throats of the baby birds.

"The little ones were not many hours old before the male insisted on presenting to them a few tidbits himself; and in a few days the parents fed the young almost exclusively on fresh insect food, which grew larger and tougher as the days went by."

She mentions two attempts of the parent birds to draw her away from their young: "Once I accidentally flushed a brooding magnolia. The bird disappeared into the underbrush, but soon attracted my attention to herself by calling from the top of a second-growth fir, a few yards from where her precious secret was concealed. Then she fell from branch to branch, striking the boughs with a thud, like a dead weight, and dragged an apparently helpless leg or wing over the ground, but always away from where her treasures were hidden. On another occasion, when I visited a family of magnolias that were quite ready to fly, the little ones spilled over the side of the cradle into the surrounding grasses and ferns. Both parent birds, with spread wings and tail, tumbled from all the seedlings in the vicinity and trailed around in widening circles, calling piteously. At last the male bird poised himself in air on fluttering wings between me and a callow youngster, but the moment I lessened the distance between us he vanished."

Henry Mousley (1924) recorded his observations on two nests of magnolia warblers, and found that during a period of 15 hours, at one nest containing very young birds, the male fed the young 34 times and the female 58 times; the average rate of feeding was once in 9.8 minutes; the female did all the brooding for a total of 6 hours and 19 minutes; the faeces were eaten 9 times and carried away 17 times, about equally by each sex.

Margaret Morse Nice (1926) made a very elaborate study of the happenings at another nest; her account, containing many interesting observations, to which the reader is referred, is too detailed to be quoted here. Her table shows that she watched the nest for a total of 26½ hours, spread over a period of 9 days; during this time, the young were fed by the male 118 times and by the female 91 times; the average rate of feeding was once in 7.8 minutes; the female brooded 33 times for a total of 352 minutes; the faeces were eaten 8 times and carried away 38 times.

Aretas A. Saunders (1938) writes: "After the young have left the nest, they are much in evidence in the forests. As soon as this happens, whatever territory there was is abandoned. The young wander away, keeping together, and the parents care for them, feeding them frequently for the first few days. Both sexes feed the young, but after a day or two only the male is likely to be in attendance. Young in this stage are easily located by the incessant hunger calls. These calls consist of three or four high-pitched notes, *tsee tsee tu—tsee tsee tsee tu—tsee tsee*, etc. I cannot distinguish the call made by young of this species from those made under similar circumstances by the young of the black-throated green and blackburnian warblers."

I have also received from Mrs. Doris Huestis Speirs and from Mrs. Louise de Kiriline Lawrence very full reports on their observations at two nests of magnolia warblers in Ontario. Many of their observations were similar to those mentioned; however, the following should be noted here: Mrs. Lawrence found the incubation period to be about 11 days, incubation and brooding being by the female only. The young were fed by both parents by regurgitation for the first 3 days, and after that on solid food, mostly caterpillars; in 49 minutes, the male fed them 7 times and the female 5 times. During 5½ hours, the male ate or carried away the fecal sacks 15 times. The young left the nest on the ninth day after hatching, and were fed by their parents up to the twenty-fifth day after leaving the nest; after that they were seen feeding themselves. Mrs. Speirs kept an accurate record of the brooding periods, which were from 8 to 45 minutes in length, but seldom less than 20 minutes, the female leaving the nest for periods of from 3 to 15 minutes. At times she closed her eyes and seemed to doze; occasionally she rose and turned the eggs with her feet or bill. The presence of birds of other species approaching or flying over did not seem to disturb her but the movements of a red squirrel in the vicinity kept her alert. The story of this nest ended in tragedy; some predator destroyed all but one of the young, the female finally disappeared and eventually there was nothing in the nest but an unhatched egg. A sharp-shinned hawk had been seen flying over.

Plumages.—Dr. Dwight (1900) calls the natal down "sepia-brown," and describes the juvenal plumage as "above, dark sepia-brown, soon fading, usually paler on the crown and obscurely streaked with clove-brown. Wings and tail dull black, chiefly edged with ashy or plumbeous gray, the secondaries, tertiaries and wing coverts with drab, two wing bands pale buff; the rectrices white on inner web of basal half. Below, pale sulphur-yellow, dusky or grayish on the throat, and streaked or mottled except on the abdomen and crissum with deep olive-brown. Lores and orbital region ashy brown."

The amount of yellow on the under parts is quite variable, the youngest nestlings showing very little or none at all. The sexes are practically alike in the juvenal plumage, but become recognizable during the first fall.

The postjuvenal molt begins early in July and involves all the contour plumage and the wing coverts, but not the rest of the wings or the tail.

This produces the first winter plumages, in which the young of each sex closely resemble their respective adult counterparts at that season but the colors are all duller, the crown and back are browner, there is a dusky band on the upper breast, and the black streaking is paler or obscure.

Dr. Dwight (1900) says: "First nuptial plumage acquired by a partial prenuptial moult which involves most of the body plumage, the wing coverts and sometimes a few tertiaries, but not the rest of the wings nor the tail. Young and old become practically indistinguishable except by the wings and tail, especially the primary coverts, all of which are usually browner and more worn than in adults." According to Dickey and van Rossem (1938) this takes place in El Salvador early in April and is completed very rapidly.

Subsequent molts of adults consist of a complete postnuptial molt in July and August and an extensive prenuptial molt in April, as described above. Dr. Chapman (1907) says that the adult male in the fall is quite unlike the spring male; "crown and nape brownish gray; eye-ring whitish [instead of white spot below and a white line behind the eye]; * * * rump yellow; tail as in Spring; wing-coverts *tipped* [instead of broadly marked and forming a conspicuous white patch] with white forming two white bars; below yellow, sides with partly concealed black streaks, upper breast with a faint dusky band." The fall female differs in a similar way from the spring female, having a browner crown and the dusky band on the upper breast well developed, much as in the young male in the fall. The female is always much duller than the male in all plumages.

Food.—Ora W. Knight (1908) writes: "The food consists largely of beetles, grubs, flies, worms and similar insects. I have seen the birds prying frequently into the deformities on spruce and fir produced by a species of licelike insects (*Adelges*), and feel very sure that they do good work in destroying these pests, which are becoming very numerous in some sections of the State [Maine] and injuring the spruce and fir trees."

W. L. McAtee (1926) praises its good looks as well as its usefulness by saying: "The beautiful Black and Yellow Warbler is a common summer resident of the higher parts of the Catskill and Adirondack regions, and breeds sparingly in local cool spots elsewhere in the State [New York]. * * * So far as known its food in our region consists entirely of insects and associated creatures, as spiders and daddy-long-legs. Almost all of its known items of insect food are sorts injurious to woodlands. It takes weevils, leaf bettles, and click beetles, leaf hoppers, plant lice, and scale insects, sawfly larvae and ants, and caterpillars and moths. Surely a record of good deeds to match the excellence of appearance of this feathered gem."

F. H. King (1883) reports from Wisconsin: "Of seventeen specimens examined, three had eaten four hymenoptera, among which were two ants; one, one moth; six, seventeen caterpillars; six, fifteen diptera; six, twelve beetles; and one, two larvae. Two tipulids were represented among the diptera." Professor Aughey (1878) counted as many as 23 locusts, probably in nymphal stages, in the stomach of a magnolia warbler collected in Nebraska. And F. L. Burns (1915a) included this species with the Cape May warbler as feeding on cultivated grapes.

Behavior.—The magnolia warbler is not only one of the most beautiful—to my mind, the most beautiful—of wood warblers, it is one of the most attractive to watch. It frequents, especially on its breeding grounds, the lower levels in its forest haunts, where it can easily be seen. It is most active and sprightly in its movements as it flits about in the small trees or bushes, with its wings drooping and its tail spread almost constantly, showing the conspicuous black and white markings in pleasing contrast with the brilliant yellow breast, the gray crown, and the black back; it seems to be conscious of its beauty and anxious to display it. Its rich and vivacious song, almost incessantly uttered during the early part of the nesting season, attracts attention and shows the nervous energy of the active little bird. It is not particularly shy and is quite apt to show itself at frequent intervals, as if from curiosity. The female sits closely on her nest until almost touched, and then slips quickly off to the ground and disappears. But both of the parents are devoted to their young and quite bold in their defense, as mentioned above by Miss Stanwood. At the nest that Mrs. Nice (1926) was watching the warblers paid no attention to a red squirrel that several times came within 15 feet of the nest. "In general the relations of these warblers with other birds was not unfriendly; no attention was paid to passing Chickadees nor to Chewinks and Maryland Yellow-throats that nested near. The only birds towards whom the male showed animosity were a male Myrtle Warbler that he drove away both during incubation and while the young were in the nest, and the male of his own species who came to call July 2. On July 8 the female warbler gave short shrift to an inquisitive female Black-throated Green Warbler that seemed to wish to inspect the household."

The intimate studies made by Mrs. Nice and Henry Mousley indicate that these warblers will tolerate a reasonable amount of human intimacy without showing too much timidity.

Voice.—My earliest impression of the song of the magnolia warbler was written in 1891 as *wee-chew*, *wee-chew* in full, rich notes. Later I attempted to syllabilize it quite differently; once I wrote it *switter, switter, swirr,* or *swicher, swich, a-swirr.* On another occasion it sounded like *wheet, tit, chéw,* or *wheet, wheet, tit, chéw.*

Mrs. Nice (1926) noted only two songs, "the day song and perch song *weechy weech* and the feeding and vesper song *sing sweet* with its variation *sing sing sweet.* He used three different notes: *tit* the alarm note, *kree* the love note, and *eep,* the significance of which I never fathomed."

Gerald Thayer wrote to Dr. Chapman (1907):

> The Magnolia belongs among the full-voiced Warblers, and is a versatile singer, having at least two main songs, both subject to much and notable variation. The typical form of the commoner song is peculiar and easily remembered: *Weeto wecto weétee-eet,*—or *Witchi, witchi, witchi tit,*—the first four notes deliberate and even and comparatively low in tone, the last three hurried and higher pitched, with decided emphasis on the antepenult *weet* or *witch.* The other song has the same general character, and begins with nearly the same notes, but instead of ending with the sprightly, high-pitched *wéetee-eet',* it falls off in a single perfunctory-sounding though emphatic note, of *lower* tone than the rest. In syllables it is like *Witti witti wét,'—weetee weetee wûr.*

He proceeds to mention some variations:

> One such variant I have fixed in my own recollection by the syllables *Ter-whiz wee-it*; and another, almost unrecognizable, by the syllables *Weé-yer weé-yer wee-yer.* Still another beginning like *Weechi wéech,* ended with a hurried confusion of small notes, some low, some high. But throughout these and all the many other surprising variations I have heard about Monadnock, the characteristic tone-quality was preserved unchanged, and so were certain minor tricks, scarcely describable, of emphasis and phrasing. The tone is much like the Yellow Warbler's and also the Chestnut-side's, though distinctly different from either. In loudness it averages lower than the Yellow's and about equal to the Chestnut-side's.

Then he mentions a peculiar call note, *tlep, tlep,* a lisping note with a slight metallic ring, that reminded him of the siskin or of Henslow's sparrow.

The following remarkable list of seven distinct songs recognized by Stewart Edward White (1893) is included because it represents either some very unusual variations or very keen observation:

> 1. Three notes followed by one lower: *che-weech che-weech che-ó.* 2. Three sharp clear whistles with a strong *r* sound, then a warble of three notes, the middle the highest, the latter clear and decisive: *pra pra pra r-é-oo.* 3. Two quick sharp notes followed by a warble of three notes, the middle the highest: the warble is soft and slurred: *prút pút purreao.* 4. A soft falsetto warble, different in tone from any other bird song: *purra-ĕ-whuy-a.* 5. Of the same falsetto tone uttered rapidly: *prut-ut-ut-ut-ut.* 5. A harsh note like, in miniature, the cry of a Jay: *d kay kay kay.* 7. A harsh *k-e-e-c-dl,* the last syllable higher by a shade, quick, and subordinated to the first part. The alarm note is a sharp *zeek.*

Mr. Brewster (1877) has written his impression of the song in words as, "*she knew she was right; yes, she knew she was right.*"

Elsewhere, he writes it: "*Pretty, pretty Rachel.*" The latter version seems to suggest the rhythmic swing of the song very well.

Francis H. Allen (MS.) gives me several somewhat similar renderings, and mentions a migrating bird that sang for a long time early one morning in the spruces and hemlock near his house: "It was such steady and unintermittent singing as I have seldom if ever heard from any other warbler, and the bird alternated very regularly between the first and second songs—*weetle weetle weetle weet*, then *will′ you wée sip*, or *will′ you will′ you wée sip*, the latter song not so emphatic as usual and weaker than the other." This alternation is not uncommon with some species of warblers, as the redstart, but I have no records of it for the magnolia. He also mentions a common call note, "a dry 2-syllabled note, *tizic*, a little suggestive, perhaps, of the song of the yellow-bellied flycatcher", which he thinks has no counterpart among our warbler notes.

Aretas A. Saunders has lately sent me a full account of the song of this warbler, saying, in part: "The song of the magnolia warbler is a short one, commonly of six or seven notes, of a weak, rather colorless, but musical quality. My 49 records of this song show that the number of notes varies from 4 to 9, all but 8 of them being of either 6 or 7 notes. The 6-note songs usually consist of three, 2-note phrases. The first two are just alike, the 2 notes of each phrase on different pitches. The third phrase is either higher or lower in pitch, and frequently with the order of pitch from low to high or from high to low reversed.

"The majority of the songs have a range, in pitch, of two or two and a half tones, nearly always between A ′ ′ ′ and D ′ ′ ′ ′. A few songs range as much as three and a half tones, and may be as low as F ′ ′ ′ or up to E flat ′ ′ ′ ′, but the range for the species is only five tones.

"The songs are quite short, ranging from 3/5 second to 1 2/5 seconds. Individual birds often sing two or three different songs, or vary songs by dropping or adding notes.

"The song period extends from the arrival of the bird in migration to late July or early August. The average date of the last song in 14 years in Allegany Park is August 1. The earliest is July 26, 1933, and the latest August 15, 1937."

Enemies.—Dr. Friedmann (1929) mentions only a few cases in which the magnolia warbler has been imposed upon by the cowbird, but E. H. Eaton (1914), says that the cowbird "seems to make a specialty of presenting this Warbler with one or more of its eggs, generally puncturing the eggs of the Magnolia before leaving the nest." However, it is probable that this warbler is a rather uncommon victim, perhaps because the cowbird is not particularly common in the places where the warbler breeds.

Harold S. Peters (1936) lists two lice, *Degeeriella eustigma* (Kellogg) and *Myrsidea incerta* (Kellogg), as external parasites on this warbler.

Field marks.—The adult magnolia warbler of both sexes is so conspicuously marked that it should be easily recognized. The gray crown, black back and cheeks, yellow breast and rump, the two broad white wing bars and the large amount of white in the tail, midway between the base and the tip, are all good field marks. The female is only a little less brilliant than the male. The young bird in juvenal plumage is quite different, but the position of the white in the tail is distinctive.

Fall.—When the young birds are well able to take care of themselves, they and their parents join the gathering throngs of warblers and other small birds in preparation for the southward migration. Brewster (1877) writes:

> In Eastern Massachusetts this species occurs as a fall migrant from September 21 to October 30, but it is never seen at this season in anything like the numbers which pass through the same section in spring, and the bulk of the migration must follow a more westerly route. Its haunts while with us in the autumn are somewhat different from those which it affects during its northward journey. We now find it most commonly on hillsides, among scrub-oaks and scattered birches, and in company with such birds as the Yellow-Rump (*Dendroeca coronata*) and the Black-Poll (*D. striata*). A dull, listless troop they are, comparatively sombre of plumage, totally devoid of song, and apparently intent only upon the gratification of their appetites.

Brewster was probably correct in assuming that the main trend of the fall migration is more westerly. Milton B. Trautman (1940) says of the fall migration of the magnolia warbler at Buckeye Lake, Ohio: "A persistent search in mid-August always resulted in recording a few early transients, and by the last of the month several were seen each day. The numbers increased gradually through early September. From September 10 to 25 the greatest daily numbers were attained, and 50 to 125 birds a day were noted. The numbers were slightly higher than they were in spring. The fall transients frequented the same types of habitat as did the spring birds, except that more were found in brushy fields or pastures, especially those dotted or thicketed with hawthorn and wild plum."

Prof. W. W. Cooke (1904) writes:

> Over much of the southern part of the United States the magnolia warbler, though rare in spring, is common in fall. * * * The general path of migration of the species seems to cross the middle of the Gulf of Mexico. It is bounded approximately on the east by a line drawn from the north central part of Georgia to eastern Yucatan, while few individuals seem to proceed farther west than the coast line from eastern Texas to southern Vera Cruz. In common with some twenty other species of birds the magnolia warbler seems to make its flight between the United States and Yucatan without taking advantage of the pen-

insula of Florida or using Cuba as a stopping place. At the southern end of the Allegheny Mountains it is a common migrant, while it has been noted only three times in Florida and only once in Cuba.

Winter.—Dr. Alexander F. Skutch contributes the following from Costa Rica: "The magnolia warbler is one of the abundant winter visitants of northern Central America. Although its known winter range extends to Panamá, it only rarely migrates so far south. I have never seen the bird either in Panamá or Costa Rica; nor did Carriker have any record of it when he prepared his list of the birds of the latter country. But in the Caribbean lowlands of Honduras and Guatemala, it is common and widespread from October to April, sharing with the yellow warbler the distinction of being the member of the family most often seen during this period. While it appears to be present in somewhat smaller numbers than in the Caribbean region, it is still far from rare on the Pacific side of Guatemala. Here I found it fairly abundant, during the winter months, on the great coffee plantations between 2,000 and 4,000 feet above sea-level. It was not uncommon in the bushy growth about the shores of Lake Atitlán (4,900 feet), at the end of October; and I even found a few among the pines and oaks at Huehuetenango, at an altitude of 6,600 feet in the western highlands, on November 12, 1934; but I am not at all certain whether they remained so high during the cooler months that followed. In its winter home, this sprightly bird lives singly rather than in flocks. It frequents open groves, light second-growth woodland, thickets, and the riverside vegetation, rather than the heavy forest.

"The magnolia warblers arrive in Guatemala and Honduras in their dull winter dress, at the end of September or in October. By early April, the males are in full nuptial attire, so bright and gay that their approaching departure will deprive the region of one of its most beautiful birds. They linger until the end of April; and I have seen males as late as females.

"Early dates of fall arrival in Central America are: Guatemala—passim (Griscom), October 12; Colomba, September 30, 1934; Finca Helvetia, October 6, 1934. Honduras—Tela, October 6, 1930.

"Late dates of spring departure from Central America are: Honduras—Tela, April 24, 1930. Guatemala—passim (Griscom), April 15; Motagua Valley, near Los Amates, April 30, 1932."

Dickey and van Rossem (1938) record it for El Salvador as a—

> rare fall migrant, but common winter visitant and spring migrant in the Arid Lower Tropical Zone. Although found from sea level to 3,500 feet, the species is much more numerous below 2,000 feet than above that altitude. Dates of arrival and departure are October 12 and April 24. * * *
>
> In December perhaps a dozen all told were seen on Mt. Cacaguatique, always as single birds with small flocks of Tennessee and other warblers. By January

they had become very common, and at Puerto del Triunfo during the whole of that month and in February at Rio San Miguel almost every flock of blue honey creepers was accompanied by one or more magnolia warblers. There was no noticeable decrease in numbers until after the middle of April, and even on the 24th (the last date on which the species was noted) they were recorded as common.

DISTRIBUTION

Range.—Central Canada to Panamá.

Breeding range.—The magnolia warbler breeds **north** to southwestern Mackenzie (Wrigley, Providence, and Resolution); northeastern Alberta (Chipewyan); central Saskatchewan (Flotten Lake, Emma Lake, and Hudson Bay Junction); central Manitoba (Cedar Lake, Norway House, and Oxford House); northern Ontario (Red Lake, Lac Seul, and Moose Factory); southern Quebec (Lake Mistassini, Mingan, and Natashquan); and northern Newfoundland (Northeast Brook, Canada Bay). **East** to eastern Newfoundland (Northeast Brook, Badger, and Princeton) and Nova Scotia (Baddeck, Cape Breton Island). **South** to Nova Scotia (Baddeck, Halifax, and Barrington); southern Maine (Ellsworth, Bath, Portland, and Saco); southern New Hampshire (Concord and Monadnock); northwestern Massachusetts (Winchendon and Pelham); northeastern Pennsylvania (Lords Valley, Delaware Water Gap, and Pottsville); western Maryland (Cumberland); central western Virginia (Sounding Knob); central eastern West Virginia (Watoga and Pickens); occasionally western North Carolina (Asheville); northeastern Ohio (Pymatuning Bog and Conneaut); possibly northwestern Ohio (Toledo); northern Michigan (Grayling, Wequetansing, and the Beaver Islands); northern Wisconsin (Kelley Brook, Ashland, and Superior); northern Minnesota (McGregor, Leech Lake, and White Earth); southern Manitoba (Winnepeg and Brandon); southern Saskatchewan (Indian Head, Wood Mountain, and Maple Creek); central Alberta (Stony Plain, Lesser Slave Lake, and Winagami); and central British Columbia (Field, Quesnel, Mukko Lake, and Hazelton). **West** to western and northern British Columbia (Hazelton and Liard Crossing); and southwestern Mackenzie (Nahanni Mountains and Wrigley). Accidental or casual north to Fort Franklin.

Winter range.—The magnolia warbler is found in winter **north** to northern Puebla (Metlatoyuca); Veracruz (Tlacotalpan); and Quintana Roo (Puerto Morelos and Cozumel Island). **East** to Cozumel Island; British Honduras (Orange Walk and Belize); Honduras (Tela and Ceiba); Nicaragua (Río Escondido); and Panamá (Canal Zone). **South** to Panamá (Canal Zone and Almirante). **West** to western Panamá (Almirante); Costa Rica (Guayabo); El Salvador (Puerto del Triunfo); Guatemala (San Lucas); Oaxaca (Tehuantepec); western Veracruz (Motzorongo); and northern Puebla (Metlatoyuca). Occasional or accidental in winter (possibly from delayed migration), in southern Sonora (Alamos); Texas (Brownsville, Dallas, and Huntsville); Mississippi (Edwards and Gulfport); Alabama (Tupelo); and Florida (New Smyrna). It has also occurred rarely in migration in the West Indies; Cuba (Habana); Dominican Republic (Puerto Plata); and Puerto Rico (Mayagüez).

Migration.—Late dates of spring departure from the winter home are: Nicaragua—Edén, March 29. El Salvador—Chilata, April 24. Guatemala—Chuntuqui, April 25. Honduras—Tela, April 24. Veracruz—Minatitlán, April 27. Puerto Rico—San Germán, April 20. Cuba—Santiago de las Vegas, May 4.

Early dates of spring arrival are: Florida—Palm Beach, March 3. Alabama—Long Island, April 10. Georgia—Savannah, April 13. South Carolina—Summerton, April 17. North Carolina—Waynesville, April 14. Virginia—Lynchburg, April 18. West Virginia—White Sulphur Springs, April 25. District of Columbia—Washington, April 22. Pennsylvania—Pittsburgh, April 22. New York—Canandaigua, April 23. Massachusetts—Amherst, April 29. Vermont—St. Johnsbury, April 29. Maine—Dover-Foxcroft, May 5. New Brunswick—Scotch Lake, May 2. Nova Scotia—Wolfville, May 6. Quebec—Quebec, May 4. Prince Edward Island—Mount Herbert, May 4. Louisiana—Avery Island, April 6. Mississippi—Edwards, April 17. Arkansas—Helena, April 20. Tennessee—Knoxville, April 17. Kentucky—Bowling Green, April 23. Illinois—Le Roy, April 19. Ohio—Oberlin, April 19. Michigan—Grand Rapids, April 26. Ontario—London, April 30. Missouri—Marionville, April 20. Iowa—Iowa City, April 27. Wisconsin—Milwaukee, April 26. Minnesota—Crystal Bay, April 29. Texas—Brownsville, April 3. Nebraska—Lincoln, April 29. South Dakota—Yankton, May 2. North Dakota—Argusville, May 11. Manitoba—Aweme, May 11. Saskatchewan—Wiseton, May 5. Colorado—Derby, May 3. Alberta—Glenevis, May 22. Mackenzie—Simpson, May 23.

Late dates of spring departure of transients are: Florida—Dry Tortugas Island, May 22. Alabama—Leighton, May 10. Georgia—Margret, May 25. South Carolina—Spartanburg, May 18. North Carolina—Raleigh, May 18. Virginia—Naruna, May 25. District of Columbia—Washington, June 4. Louisiana—Cameron Farm, May 15. Mississippi—Deer Island, May 21. Arkansas—Winslow, May 22. Tennessee—Nashville, May 22. Kentucky—Danville, May 27. Illinois—Chicago, June 8. Ohio—Youngstown, June 3. Missouri—St. Louis, June 3. Iowa—Mount Vernon, June 2. Texas—Waco, May 23. Oklahoma—Arnett, May 28. Kansas—Stockton, May 21. Nebraska—Stapleton, May 23. South Dakota—Yankton, June 6. North Dakota—Argusville, June 12.

Late dates of fall departure are: Alberta—Glenevis, September 18. Saskatchewan—Wiseton, September 27. Manitoba—Shoal Lake, September 28. North Dakota—Fargo, October 9 (bird banded). South Dakota—Lennox, October 5. Texas—Cove, November 13. Minnesota—St. Paul, October 2. Wisconsin—Appleton, October 18. Iowa—Sigourney, October 20. Ontario—Toronto, October 16. Ohio—Cleveland, November 2. Indiana—Elkhart, October 16. Kentucky—Bowling Green, November 10. Tennessee—Nashville, November 11. Mississippi—Gulfport, November 8. Louisiana—New Orleans, November 4. Newfoundland—Tompkins, September 25. Prince Edward Island—North River, September 8. Quebec—Quebec, September 19. New Brunswick—Saint John, October 12. Maine—Portland, September 28. New Hampshire—Hanover, October 16. Massachusetts—Lynn, October 28. New York—Long Beach, October 27. Pennsylvania—Jeffersonville, October 15. District of Columbia—Washington, October 28. Virginia—Lawrenceville, October 25. North Carolina—Raleigh, October 20. South Carolina—Cherokee Plantation, November 12. Georgia—Atlanta, November 4. Florida—Pensacola, October 31.

Early dates of fall arrival: North Dakota—Fargo, September 3. South Dakota—Aberdeen, August 26. Nebraska—Monroe Canyon, Sioux County, September 12. Texas—Brownsville, September 3. Wisconsin—New London, August 12. Iowa—Grinnell, August 20. Illinois—Chicago, August 12. Indiana—Indianapolis, August 25. Kentucky—Wurtland, August 8. Tennessee—Nashville, August 27. Mississippi—Edwards, September 7. Louisiana—September 11. District of Columbia—Washington, August 15. Virginia—Charlottesville, September 3. North Carolina—Asheville, August 28. Georgia—Athens, September 7. Alabama—Birmingham, September 13. Florida—St. Augustine, September 3. Cuba—Habana, November 3. Yucatán—Chichén-Itzá, October 7. Honduras—Truxillo, September 27. Guatemala—Colomba, September 30. El Salvador—Divisadero, October 12. Nicaragua—Río Escondido, October 27. Panamá—Cocoplum, October 24.

Casual records.—A specimen was secured in Bermuda on May 7, 1878; a specimen was collected at Godthaab, Greenland, in 1875; a bird was picked up, recently dead, at Salem, Oreg., in January 1907; and on October 1, 1913, a specimen was picked up dead on the sea ice a mile off shore from Humphrey Point, Alaska. Eight specimens have been taken in California: Farallon Islands, May 29 and June 2, 1911; at sea about 10 miles west of Halfmoon Bay, June 8, 1943; Yosemite Valley, October 6, 1919; Santa Cruz Island, May 23, 1908; Santa Barbara Island, May 15, 1897; and Los Angeles, October 21, 1897, and October 5, 1901.

Egg dates.—Maine: 95 records, June 4 to 30; 74 records, June 7 to 15, indicating the height of the season.

New Brunswick: 59 records, June 7 to 28; 37 records, June 13 to 19.

New York: 23 records, June 3 to July 1; 13 records, June 5 to 12.

Pennsylvania: 41 records, May 28 to June 13; 32 records, May 30 to June 8 (Harris).

DENDROICA TIGRINA (Gmelin)

CAPE MAY WARBLER

Plate 29

Habits

This is the bird that made Cape May famous. Dr. Stone (1937) suggests that it has "served to advertise the name of Cape May probably more widely than has been done in any other way." The inappropriate name Cape May warbler was given to it by Alexander Wilson (1831), who described and figured it from a specimen of an adult male taken by his friend, George Ord, in a maple swamp in Cape May County, N. J., in May, 1811. He never saw it in life and never obtained another specimen. Audubon never saw it in life, the specimens figured by him having been obtained by Edward Harris near Philadelphia. Nuttall apparently never saw it.

Dr. Stone (1937) writes: "Curiously enough it seems never to have been recorded again at Cape May until September 4, 1920, when I recognized one in a shade tree on Perry Street in company with some Chestnut-sided Warblers. Since then we have seen a few nearly every year in spring and fall both at Cape May and at the Point." It is perhaps not to be wondered at that the early ornithologists knew so little about it before 1860, for bird observers were few and widely scattered in those days, and the Cape May warbler is only a hurried migrant through the United States over a very wide immigration range, nowhere very abundant, and its numbers seem to fluctuate from year to year.

Some years before Wilson named the Cape May warbler, a specimen of the same bird flew aboard a vessel off the coast of Jamaica and was painted and described by George Edwards. This was the basis of Gmelin's name *tigrina*, little tiger. Although not striped exactly like a tiger, it has carried this name ever since.

Spring.—Cape May warblers leave their winter home in the West Indies in March and pass through the Bahamas and Florida in March and April, northward along the Atlantic coast, and branch out westward to southern Missouri and up through the Mississippi Valley to Minnesota and Canada. Very few stop to settle much short of the Canadian border. Dr. Chapman (1907) writes of the spring migration: "In early May in Florida, I have seen this species actually common, feeding in weedy patches among a rank growth of poke-berries. It seemed like wanton extravagance on the part of nature to bring so many of these generally rare creatures within one's experience in a single morning. Both on the east and west coasts of the State the bird is at times a common migrant, possibly bound for its summer home by way of the Mississippi Valley, where it is more numerous than in the north Atlantic States."

Amos W. Butler (1898) says:

> The Cape May Warbler is generally considered a rare bird everywhere. While this is true, and some years it is altogether absent, there are years when it is common and even abundant. In Indiana it appears as a migrant, perhaps more numerous in fall than spring. * * * Some years with us they are found upon the drier uplands, among the oak woods, where they usually keep among the lower branches or upon the high bushes and smaller trees. They are not very active, but keep persistenly hunting insects. At other times, we find them among our orchards, even coming into towns, where they occupy themselves catching insects among the foliage and about the blossoms of all kinds of shade and fruit trees.

In Ohio, according to Milton B. Trautman (1940), "the bird was uncommon in every spring except 1, and seldom more than 10 individuals were noted in a day. Between May 14 and 20, 1926, the species was very numerous throughout central Ohio. On May 16 I noted at least 40 individuals in Lakeside Woods, and it was evident that hundreds were present in the area on that day." Referring also to Ohio, W. F. Henninger (1918) writes: "This year, on May 25, 1917, we entered a large patch of woods about half a mile from the Grand Reservoir early in the morning, just when the fog had barely raised above the treetops, and the warblers were fairly swarming there, among them numbers of Cape May's. I counted more than fifty, but got tired counting and then gave it up, after taking a fine pair." Rev. J. J. Murray (MS.) refers to this warbler as common in the vicinity of Lexington, Va., in the spring from April 29 to May 18, where it seems to prefer conifers at that season.

I have seen the Cape May warbler fairly common in Florida at times and I have collected it there, but I have never seen it in my corner of Massachusetts. Mr. Forbush (1929) tells the story very well for this State:

> For nearly one hundred years at least this species had been considered very rare in New England, but about 1909 it seemed to become more common. In May, 1912, at Amesbury, Massachusetts, one chilly morning I found bright males scattered through the village. A cold wave, catching them in night migration, had brought them down, and they could be seen here and there on or near the ground, and in low bushes by the roadside. In the dooryards and along the streets these lovely birds hopped and fluttered fearlessly in their search for food, paying little attention to passers-by. By 1915 they had appeared more generally, and in May, 1917, they were well distributed over a large part of New England.

Since that time Cape May Warblers have been not uncommon transients in certain years, and they have never been as rare as they formerly were. In migration they may be found in trees and shrubbery about dwellings and along village streets almost as commonly as in woods or in swampy thickets, where at this season they find many insects. Occasionally a few may be seen in blossoming orchards.

Courtship.—Information on the courtship behavior of the wood warblers is so scanty that it seems worthwhile to include two small items on this subject for the Cape May warbler. While watching a pair at their nest-building, Dr. Merriam (1917) observed that "on June 11 the male was seen to chase the female. The next day nest building was apparently complete. An hour's watching on the 13th also failed to show any further nest construction, although the female was frequently heard in the low growth. Once she flew ten feet up in a spruce and gave a peculiar note at the same time lifting her tail. Immediately the male flew down and copulation took place. The whole proceeding resembled very much that of the Chipping Sparrow." James Bond (1937) noted at times that, "when the female was working on the nest, the male would fly with rigid wings just above her. This was a characteristic courting display, noted with other individuals."

Nesting.—The Cape May warbler seeks for its summer home the country of the pointed firs and spruces that tower like tapering church spires in the Canadian Life Zone of our northern border and in Canada. It seems to prefer an open, parklike stand of these noble trees rather than the denser coniferous forests, though it often finds a congenial home along the borders of the forests or in the more open spaces within them, especially where there is a mixture of tall white or yellow birches, or a few hemlocks. Its breeding range follows the Canadian Zone rather closely, as along the cool coastline of eastern Maine. James Bond writes to me of its interesting distribution in that state: "In the eastern half of the state it is found mainly along the coast, as far south as Hog Island, Knox County. It ranges across Maine through Washington, Aroostook and northern Penobscot Counties, but is a rare species in the interior, and is unknown in summer from the Bangor and Lincoln sections of Penobscot County. I found it most abundant in southern Mount Desert Island in the vicinity of Ship Harbor. Here several pairs nest every year in the cool, often fog-drenched woods, although I have found but one nest."

The first published report of the nesting of the Cape May warbler was perhaps based on an error in identification. Montague Chamberlain (1885) reported that his friend James W. Banks found a nest apparently "just outside the city limits" of Saint John, New Brunswick; he states that it "was hid among a cluster of low cedars growing in an exposed position, on a rather open hill-side, near a gentleman's residence, and within a stone's throw of a much frequented lane. The nest was placed less than three feet from the ground and within six inches of the tips of the branches." The location of this nest, as will be seen from the accounts that follow, was entirely different from that of the many nests found since; both nest and eggs were said to resemble somewhat those of the magnolia warbler; no male Cape May warbler was seen or heard, and the bird Banks reports having shot from the nest may have been wrongly identified, since the females of the two species are somewhat alike. Referring to this account, James Bond (1937) remarks: "It would be wise to regard the 'classical' nest taken near Saint John, New Brunswick, by Banks as that of a Magnolia Warbler, as is indicated not only by its situation but by its construction, for the nest of the Cape May Warbler is a decidedly more bulky affair. I mention this since recent books still perpetuate this undoubted error, ignoring the information that has been gleaned during the past twenty years."

Probably the first undoubted nest of the Cape May warbler was found on an island in Lake Edward, Quebec, on June 7, 1916, by Dr. H. F. Merriam, who published an interesting account of it (1917). He watched the building of the nest for some days before the nest was taken on the eighteenth. The female was seen carrying nesting material into the thick top of a spruce about 40 feet from the ground in a rather open part of the woods, consisting for the most part of spruce and balsam of moderate size interspersed with large white and yellow birches.

> The female was not at all timid and apparently gathered most of her nesting material at two places, both within sixty feet of the nest tree. * * * While searching in the low growth she was absorbed in manner, giving only occasionally a sharp chip. In going to the nest her actions were more rapid and she chipped more frequently, generally alighting ten to twenty feet below the nest and working her way up from limb to limb on the outside of the tree. * * * The male was not seen to carry any nest material but seemed to be generally in the immediate neighborhood. At times he accompanied the female part way to or from the nest and sometimes remained near her in the low spruces. * * *
>
> The nest was placed about six feet from the top of the tree on a short branch nine inches from the trunk and an equal distance from the tip. From the ground it could not be seen even with field glasses. From a few feet below the nest was apparently a green ball of moss. Closer examination, however, showed it to be a neatly cupped nest resting on the branch and short twigs. To these it was not securely tied and was lifted intact from its position without difficulty.
>
> The exterior of the nest was of green Sphagnum moss, interwoven with vine stems, and a very few twigs, bound lightly with plant down, small wads of which appeared here and there over the moss. The body of the nest consisted of fine grass stems. Within this was a lining of white hairs apparently from the rabbit, one small partridge feather and a few fine black rootlets. The nest was bulky but very neatly and fairly compactly put together. At the rim one side was very smoothly finished. This was probably the entrance side toward the tree trunk. It was an unusual and beautiful nest.

Its dimensions were: outside, 4 inches wide by 2¼ deep; inside, 1¾ inches wide by 1 inch deep.

Two years later, Philipp and Bowdish (1919) found four nests in northern New Brunswick. "They were in rather high spruce trees, within two or three feet of the extreme top, usually as near the top as suitable site and cover could be secured. All were built in very thick foliage, against the main stem of the tree, resting lightly on twigs and foliage, but fairly secured thereto by webs, and were entirely invisible from the ground, in every case." The nests were from 35 to 40 feet above the ground, and were not substantially different in size and construction from that described by Dr. Merriam. They add that the thick lining of hair, feathers, and a little fur, all smoothly felted, serves to distinguish the nests from those of the black-poll and myrtle warblers, and note that the nest tree is usually "fairly openly situated, at least as to one side, although this is not always the case, since other pairs watched were very evidently nesting in trees where it was much more difficult to detect them."

Richard C. Harlow has sent me the data for seven nests of the Cape May warbler that he collected in Tabusintac, New Brunswick, in 1919. Two of these were 55 feet from the ground in a fir, and the others were 35, 45, 50, 55, and 60 feet up, respectively, in black spruces. All were in the very topmost shelters of the trees, and three of them were in heavy forests, the others being on the edges. In other respects they were similar to those described above. The females sat very closely until almost touched, and then dropped down to the ground.

The nest found by James Bond (MS.) on Mount Desert Island, Maine, was against the trunk of a red spruce 38 feet above ground and about 4 feet from the extreme top of the tree. In construction it was similar to those described above. In his published (1937) paper the tree was said to be a black spruce, but he now writes to me that it was a red spruce and that there were no black spruces in the immediate vicinity; these two spruces are difficult to distinguish.

Dr. Paul Harrington, of Toronto, writes to me that he found a nest of the Cape May warbler in an open spruce forest near Dorcas Bay, Bruce Peninsula, on June 12, 1934. "The tree was about 35 feet high, a typical 'church spire.' Near the top was a heavy clump, but I could see nothing that indicated a nest; when I put my hand in the heavy needles near the trunk a bird popped out and straight down. * * * I carefully groped about and eventually found the nest, built near the trunk in the uppermost clump of needles."

Eggs.—Mr. Harlow tells me that the Cape May warbler lays from 4 to 9 eggs to a set. The larger numbers must be very rare, but 6 or 7 seem to be the commonest numbers among my records, and sets of 4 seem to be uncommon. The eggs vary in shape from ovate to short ovate and are almost lusterless. They are creamy white, richly spotted and blotched with shades of reddish brown, such as "auburn," "chestnut," "sayal brown," "bay," or "snuff brown," with an occasional scrawl of black. The undermarkings are of "fawn," "light brownish drab," "brownish drab," or "light mouse gray." The markings are more concentrated at the large end. The measurements of 50 eggs average 16.8 by 12.5 millimeters; the eggs showing the four extremes measure 18.4 by 12.3, 18.0 by 14.0, 15.0 by 12.0, and 16.0 by 11.5 millimeters (Harris).

Plumages.—Dr. Dwight (1900) describes the juvenal plumage, in which the sexes are alike, as "above, dark hair-brown, olive tinged on the back. Wings and tail black, edged chiefly with dull brownish olive-green, the coverts with drab and tipped with buffy white. The two outer rectrices with subterminal white spots. Below, including sides of head, mouse-gray with dusky mottling or streaking on the breast and sides; the abdomen and crissum dingy white faintly tinged with primrose-yellow."

The partial postjuvenal molt, beginning early in July, involves the contour plumage and the wing coverts, but not the rest of the wings or the tail. This produces the first winter plumage, in which the sexes begin to differentiate. Dr. Dwight describes the first winter male as "above, dull olive-green, each feather centrally clove-brown veiled with olive-gray edgings; the rump canary-yellow, the feathers basally black. Below, including sides of neck, superciliary lines and spot under eye, canary-yellow, palest on abdomen and crissum, narrowly streaked on sides of chin, on the throat, breast and sides with black which is veiled by grayish edgings; auriculars mouse-gray." The young female, he says, is "duller and browner above, and generally without yellow below, being dull white with gray streaking."

The first nuptial plumage is acquired by a partial prenuptial molt beginning in late winter, "which involves much of the body plumage but not the wings nor the tail. The black crown, the streaks on the back, the chestnut ear-patches and the streaked yellow of the throat and breast are acquired," in the male. The female in first nuptial plumage "shows a little yellow assumed by a limited prenuptial moult." Both sexes are now in nearly fully adult plumage, except for the worn juvenal wings and tail.

Adults have a complete postnuptial molt in July and probably a partial prenuptial molt, as in the young bird, though there is not enough pertinent material available to prove the latter. Dr. Dwight (1900) says that the adult winter plumage of the male is "similar to first winter plumage but the head black, the back streaked and everywhere veiled with smoke-gray edgings. Below, whitish edgings obscure the black streaks, the chestnut ear-coverts and the bright lemon-yellow areas. The wings and tail are blacker than in first winter, the back is black, either streaked or spotted, and the yellow below is deeper." Of the female, he says: "The adult winter plumage is similar to the male in first winter dress, the yellow below rather paler and with less heavy streakings."

Food.—Throughout most of the year the Cape May warbler is insectivorous, and mainly beneficial, but for a short time on its fall migration it undoubtedly causes damage to ripe grapes by puncturing them to obtain the juice, often ruining a large percentage of the crop. Many complaints have been made and several have been published. Frank L. Burns (1915a) claimed that about 50 percent of his crop was destroyed at Berwyn, Pa., and says: "I believe that grape juice was the principal food of the Cape May Warbler during its lengthy visit in this neighborhood. It was present in countless numbers at Berwyn and vicinity as far as a mile south of the village, apparently by far the most abundant species for a period; the complaints of the the 'little striped yellow bird' were many, and so far as I am able to learn, all unbagged grapes were ruined; the loss must have been many tons worth several hundred dollars." He sent ten stomachs to the Biological Survey for analysis and received the following reply:

> Hymenoptera constituted on an average 57.5 percent of the contents of the stomachs. A third perhaps of this material was parasitic Hymenoptera and their destruction counts against the bird. The others were ants and small bees and are of neutral importance except perhaps the ants which may be injurious. Diptera made up 16.7 percent of the stomach contents and again a large proportion of them were parasitic species. Lepidoptera (small moths) constitute 16.7 per cent, beetles 7.8 percent and the remainder was made up of Hemiptera, spiders and miscellaneous insects. Except for the spiders the food was entirely composed of insects, and a large proportion of useful species were taken and no decidedly injurious ones. I should say that these Cape May Warblers did very little to pay for the destruction of grapes.

McAtee (1904), after investigating the damage done on grapes by this and the Tennessee warbler in Indiana, published the following report on the contents of a single stomach of a Cape May warbler:

> 8 *Typlocyba comes*, an especial pest of the grape, "an exceedingly abundant and destructive" jassid; 3 *Aphodius inquinatus* and one Carabid, kinds which may be considered neutral economically, but, in case of a departure from their ordinary diet, would on account of vegetarian tendencies become injurious; 1 *Drasterias sp.* (click-beetle), 1 tortoise-beetle, 1 flea-beetle (*Haltica chalybea*), all injurious beetles, the last of which is a particular enemy of the grape, which "appears on the vine in early spring and bores into and scoops out the unopened buds, sometimes so completely as to kill the vine to the roots," and later in the season in both larval and adult stages feeds upon the foliage, and if abundant "leaves little but the larger veins"; 1 *Notoxus* sp., a weevil, with all the undesirability characteristic of the creatures bearing that name; 2 ants, harmful, if for no other reason than harboring plant lice; and a vespoidean hymenopteron (wasp) of neutral significance. * * *

> The feeding habits of the birds may, from the present knowledge, be declared practically entirely beneficial. In return it seems not too much to expect that we should without complaint furnish, for a few days in the year, the drink to wash the great numbers of our insect enemies down to their destruction; and to consider these two little fellows as among the worthiest as they are among the prettiest of our warbler friends.

Prof. Maurice Brooks (1933), speaking of this warbler in West Virginia, says:

> We had at that time [1909] a small commercial vineyard, and during the first week in September, when the crop was just ripening, we were surprised to find in the vineyard swarms of Cape May Warblers. We were not long in doubt as to their purpose there, for within a week they had destroyed practically every grape we had. * * * Their method was to puncture the skin of the berry at one point, extract a little juice, and move on to the next. They would systematically work over every berry in the cluster, if undisturbed, and they soon became exceedingly tame. It is no exaggeration to say that there were hundreds of the birds in the locality.
>
> After the birds had made one puncture, swarms of bees and wasps soon finished the work of destruction. There was no way of frightening so many birds away, and we were driven to sacking our grapes in the future. The next year, 1910, they returned in numbers again, destroying practically all unsacked clusters, and completely cleaning out the vines of our neighbors, who raised just a few grapes for their home use.

These and other warblers have been seen drinking sap from the holes dug in trees by sapsuckers, but they also obtain some insects from such borings and perhaps also from the punctured grapes, which make fine insect traps. However, the damage does not seem to be universal, and occurs only where the birds are abundant, and then for only a short time. In view of his record as an insect destroyer, the laborer may be worthy of his hire.

To the insects mentioned as food for this warbler, A. H. Howell (1932) adds small crickets, flies, leaf hoppers, termites, larvae of moths, dragonflies, and daddy-long-legs.

Behavior.—Brewster (1938) writes:

> It keeps invariably near the tops of the highest trees whence it occasionally darts out after passing insects. It has a habit of singing on the extreme pinnacle of some enormous fir or spruce, where it will often remain perfectly motionless for ten or fifteen minutes at a time; on such occasions the bird is extremely hard to find, and if shot is almost certain to lodge on some of the numerous spreading branches beneath. * * * In rainy or dark weather they came in numbers from the woods to feed among the thickets of low firs and spruces in the pastures. Here they spent much of their time hanging head downward at the extremity of the branches, often continuing in this position for nearly a minute at a time. They seemed to be picking minute insects from the under surface of the fir needles. They also resorted to a thicket of blossoming plum trees directly under our window, where we were always sure of finding several of them. There were numerous Hummingbirds here also, and these, the Cape Mays were continually chasing.

While watching a pair at their nest building, Dr. Merriam (1917) saw a female on the ground gathering material; she "was attacked by a Junco and after a chase the Junco actually caught and held her. At this commotion the male Cape May flew down and lit close by but took no active part in the argument. The Junco was apparently victor for after one more flight to her nest the female Cape May was not again seen to trespass on the Junco's territory or do any more nest building that morning." However, in his notes from West Virginia, Dr. J. J. Murray says that "this warbler is more active and restless in its feeding than any of our warblers, except possibly the myrtle; and it is also noisier and more aggressive in its attitude toward other warblers which seek to share its feeding places." Harlow also says that "the male Cape May is the tiger of the north woods in defending his territory. He attacks all birds that come close to the nest, up to the size of the olive-backed thrush, and is absolutely fearless."

Voice.—Aretas A. Saunders sends me the following note on the song of this warbler: "I have had few opportunities to study the song of the Cape May warbler, and have only five records. These show that the song is weak, high-pitched and somewhat sibillant. The notes are mainly all on one pitch, in even rhythmic time and from eight to eleven in number. They are pitched on E'''' and F''''. Two of the songs have one or two notes, near the end, a half-tone higher in pitch than the others. The songs are from 1⅗ to 2 seconds in length."

Francis H. Allen (MS.) heard one singing and feeding in some Norway spruce in West Roxbury, Mass., on May 10. "He had *chip* notes very much like a familiar note of the chipping sparrow. (I have also recorded a *prssp* like that of the blackpoll warbler but fainter and sometimes doubled.) This bird had a variety of songs. The simplest one resembled the black and white warbler's song and a short simple song of the redstart, but was thinner and harder in quality than the latter. Then there were other, more elaborate songs, some divided into two parts and some into three. Two or three times he sang several times with no pauses between, making what was practically a long continuous song. The chief characteristic of the songs, I should say, was short and staccato double notes, the latter part of which were very high-pitched. These repeated several times formed the simplest of the songs. The song in three parts reminded me of that of the Tennessee warbler, but was higher pitched and not so full and loud. The bird had long periods of silence, but sang freely when he did sing."

Brewster (1938) says that "the song of this Warbler is harder—or at least sharper and more penetrating—than that of either the Bay-breast or Blackburnian. In these respects it resembles the song of *Protonotaria* but the tone or quality is more wiry and, indeed, very close to that of *Mniotilta*."

Field marks.—The adult male Cape May warbler should be unmistakable in his brilliant spring plumage, with his black cap, chestnut cheeks, white lesser wing coverts, and bright yellow breast conspicuously streaked with black.

The female lacks the black cap and chestnut cheeks; her breast is pale yellow streaked with pale dusky; and all her colors are duller. Young birds are much like the female, but are still duller in coloration. See descriptions of other plumages. The tail-tilting habit is quite pronounced.

Fall.—The fall migration starts in August and is prolonged through September, or even into October or a little later. The birds are numerically more abundant in the fall because of the large families of young, but they are less conspicuous while the foliage is still on the trees and while they are clad in dull autumn and immature plumages. Deciduous woods seem to be their favorite haunts at this season. The migration route is a reversal of the spring route, the main flight being between the Mississippi and the Alleghenies.

In this area, the birds are often excessively abundant, as shown by the accounts in the preceding paragraphs under food. They are common in Florida on migration on their way to the Bahamas and West Indies. C. J. Maynard (1896) writes:

"They were very abundant at Key West in November, frequenting the gardens near the houses where they were searching among the tropical trees and shrubs for inescts. The birds were very unsuspicious, often clinging to branches which overhung the sidewalks within a few feet of the passengers. They appeared to prefer the inhabited portion of the Key, for I rarely found them in wooded districts. The majority left the island before the first of December, but a few remained all winter."

Winter.—Maynard (1896) says: "These birds are also common on all of the northern Bahamas which I have visited, occurring in the thickets about gardens as well as in the dense scrub. I found them abundant on Inagua in February, 1888. Here they were feeding upon the juices of a large tubular flower of a peculiar species of vine, in company with the Bahama Honey Creeper and the Lyre-tailed Hummingbird."

In Cuba, according to Dr. Barbour (1923), "a few arrive from time to time during the autumn, but in February they become really common; they stay until May. They are great flower feeders and haunt aloes and the majagua tree when it is in bloom. Many may be seen about the sisal plantations near Matanzas and in gardens where agaves blossom."

Wetmore and Swales (1931) write: "Though the Cape May warbler is found through the Greater Antilles Hispaniola appears to be the winter metropolis of the species as the birds are found throughout the island often in considerable numbers. In fact their abundance in some localities is almost bewildering to one acustomed to their rarity as migrants in the eastern United States."

DISTRIBUTION

Range.—Eastern North America and the West Indies.

Breeding range.—The Cape May warbler breeds **north** to northeastern Alberta (Chipewyan); possibly southwestern Mackenzie (Simpson); northern Saskatchewan (north shore of Lake Athabaska near Fair Point); central Ontario (Moose Factory); and southern Quebec (Lake Abitibi, Lake Edward, and Anticosti Island). **East** to eastern Quebec (Anticosti Island and Grand Grève); New Brunswick (Tabusintac and Saint John); and Nova Scotia (Wolfville and Stewiacke). **South** to Nova Scotio (Stewiacke); southern Maine (Ship Harbor, Mount Desert Island; Hog Island, Muscongus Bay; Pemaquid Point; and Auburn); northern New Hampshire (Lake Umbagog); south-central Vermont (Mount Killington); northern New York (North Elba); southern Ontario (Dorcas Bay and Biscotasing); northern Michigan (Newberry and Camp Cusino); northern Wisconsin (Kelley Brook and Harbster); rarely northeastern Minnesota (Gabro Lake); southwestern Ontario (Lac Seul); and central Alberta (Lesser Slave Lake and Sturgeon Lake). **West** to west-central and northeastern Alberta (Sturgeon Lake and Chipewyan). The Cape May warbler probably breeds in northern Manitoba since it is a regular, though not abundant, migrant in the southern part of the province.

Winter range.—The winter home of the Cape May warbler is in the West Indies **north** to the Bahamas (Nassau and Watling Island), **east** and **south** to St. Lucia, and **west** to Jamaica and western Cuba (Isle of Pines and Habana). It has also been found on the island of Roatán, Honduras. It was found in Quintana Roo not far from Xcopén on March 13 which is the second record for Mexico; the other is simply "Yucatán."

Migration.—Late dates of spring departure from the winter home are: Virgin Islands—St. Croix, April 25. Puerto Rico—Mayagüez, April 8. Haiti—Île à Vache, April 30. Cuba—Habana, May 4. Bahamas—Nassau, May 15.

Early dates of spring arrival are: Florida—Key West, March 6. Georgia—Macon, April 7. South Carolina—Chester, April 15. North Carolina—Greensboro, April 13. District of Columbia—Washington, April 19. Pennsylvania—Carlisle, April 30. New York—Geneva, April 30. Massachusetts—Amherst, May 4. Vermont—Clarendon, May 7. Maine—Auburn, May 4. New Brunswick—Scotch Lake, May 8. Nova Scotia—Pictou, May 11. Quebec—Montreal, May 14. Tennessee—Nashville, April 16. Kentucky—Russellville, April 27. Indiana—Bloomington, April 22. Ohio—Oberlin, April 27. Michigan—Ann Arbor, April 27. Ontario—London, May 1; Moose Factory, May 28. Iowa—Davenport, May 2. Wisconsin—Racine, May 2. Minnesota—St. Paul, May 2. South Dakota—Sioux Falls, May 12. North Dakota—Argusville, May 11. Manitoba—Aweme, May 10. Saskatchewan—Indian Head, May 16. Alberta—Medicine Hat, May 17.

Some late dates of spring departure of transients are: Florida—Warrington, May 18. Alabama—Anniston, May 7. Georgia—Round Oak, May 15. South Carolina—Clemson (College), May 17. North Carolina—Arden, May 19. Virginia—Naruna, May 29. District of Columbia, Washington, May 30. Pennsylvania—Doylestown, May 26. New York—Watertown, June 1. Massachusetts—Northampton, June 6. Tennessee—Nashville, May 15. Kentucky—Bowling Green, May 10. Illinois—Chicago, June 3. Indiana—Lafayette, May 31. Ohio—Austinburg—June 2. Michigan—Sault Ste. Marie, June 7. Ontario—Ottawa, June 7. Minnesota—Minneapolis, June 1. South Dakota—Sisseton, June 3. North Dakota—Grafton, June 5. Manitoba—Aweme, June 1.

Late dates of fall departure are: Alberta—Camrose, August 26. Saskatchewan—Eastend, August 29. Manitoba—Winnipeg, October 7. North Dakota—Fargo, October 3 (bird banded). Wisconsin—Racine, October 16. Iowa—Iowa City, November 27. Michigan—Detroit, October 16. Ontario—Point Pelee, October 5. Ohio—Cleveland, November 2. Indiana—Waterloo, October 15. Illinois—Rantoul, October 23. Kentucky—Bowling Green, October 15. New Brunswick—Scotch Lake, September 28. Massachusetts—Belmont, November 25. New York—Hewlett, November 15. Pennsylvania—West Chester, October 31. District of Columbia—Washington, November 26. Virginia—Sweet Briar, November 29. North Carolina, Raleigh, November 1. South Carolina—Mount Pleasant, November 3. Georgia—St. Marys, October 31. Florida—Lemon City, November 25.

The Cape May warbler sometimes lingers very late in fall migration. It has been found on Long Island at Hewlett as late as December 4; at Harrisburg, Pa., one was trapped and banded on December 5; it has twice been collected at Washington, D. C., on December 16; one was found at Bethany, W. Va., on December 7; one seen at Brownsville, Tex., on December 22; and reported in December at Key West, Fla.

Early dates of fall arrival are: Manitoba—Winnipeg, August 20. North Dakota—Fargo, September 18. Minnesota—Minneapolis, August 25. Wisconsin—Green Bay, August 1. Illinois—Chicago, August 19. Ontario—Cobalt, August 12. Michigan—Whitefish Point, August 5. Ohio—Toledo, August 14. New Hampshire—Pequaket, August 24. Vermont—Wells River, August 4. Massachusetts—Harvard, August 30. New York—Rhinebeck, August 3. Pennsylvania—Pittsburgh, August 28. District of Columbia—Washington—August 4. Virginia—Charlottesville, September 4. North Carolina—Weaverville, September 15. South Carolina—Charleston, September 13. Georgia—Savannah, September 23. Florida—Sombrero Key, September 17. Bahamas—Cay Lobos, October 20. Cuba—Santiago de las Vegas, September 20. Dominican Republic—Sánchez, October 23. Puerto Rico—Faro de Cabo Rojo, September 17.

Banding.—The one banding recovery available is especially interesting as it indicates a peculiar migration. A Cape May warbler banded at Elmhurst, Long Island, N. Y., on September 12, 1937, was caught by a cat October 15, 1937 at Cleveland, Tenn.

Casual records.—In British Columbia one was collected June 17, 1938, at Charlie Lake. In California one was collected at Potholes on the Colorado River, September 23, 1924. A specimen labeled "Arizona" taken before 1876 is in the museum in Paris. The Cape May warbler has been once observed in Bermuda, April 3, 1909.

Egg dates.—Maine: 2 records, June 6 to 15.

New Brunswick: 68 records, June 10 to 29; 43 records, June 12 to 20; indicating the height of the season.

DENDROICA CAERULESCENS CAERULESCENS (Gmelin)

NORTHERN BLACK-THROATED BLUE WARBLER

PLATES 29, 30

HABITS

This neatly dressed warbler is one of our commonest migrants throughout the eastern half of the United States, but as a breeding bird it is confined mainly to the northernmost States and to extreme southern Canada, almost wholly within the Canadian Zone. Its rather long common name describes this dainty bird.

Spring.—From its principal winter resort in the West Indies, the black-throated blue warbler migrates through the Bahamas and Florida to the Atlantic States and northward, along the Alleghenies and to the eastward of them, to its northeastern breedings grounds. According to Prof. W. W. Cooke (1904) the earliest arrivals usually strike the Sombrero Key lighthouse in Florida around the middle of April, although there are two or three exceptionally early records in March. As the average dates of arrival in New England and New Brunswick are only about a month later, it would seem that the migration is fairly rapid. But the dates of earliest arrival do not tell the whole story, for Frederick C. Lincoln (1939) observed this species in the mountains of Haiti in the middle of May, showing that there are always many late migrants.

Professor Cooke's records show that this species arrives at Asheville, N. C., a few days earlier than at Raleigh, N. C., suggesting that this is one of the few species that appear in the mountains earlier than on the plains.

There is a northward migration west of the Alleghenies corresponding almost exactly in time with that along the Atlantic slope. Cooke says that "in southern Louisiana and southern Mississippi the black-throated blue warbler is almost unknown." He gives only very few records for any point south of Indiana, and some of these may have come across the Gulf of Mexico. The inference is that the bulk of the birds that migrate northward through the central States may have crossed the lower Alleghenies into these valleys. According to his records, it takes the birds only about 10 days to migrate from Brookville, Ind., to points in Ontario.

On its migration the black-throated blue warbler shows a preference for the lower shrubbery in various kinds of woodlands, but it may also be seen almost anywhere in such suitable cover in our parks and gardens or about human dwellings. Milton B. Trautman (1940) says that, in Ohio, these and the Canada warblers "were close associates in migration and frequented the same habitat niches."

In its summer home this warbler is even more of a woodland bird, frequenting heavy deciduous woods where there is more or less thick undergrowth of mountain-laurel, rhododendron, creeping yew, deciduous bushes, small saplings, or tiny conifers. My most intimate acquaintance with the black-throated blue warbler was made while visiting at Asquam Lake, N. H., with Mr. and Mrs. Richard B. Harding. From their camp the land slopes downward to the shore of the lake and is heavily wooded with tall white oaks, swamp white oaks, red oaks, beeches, maples, paper birches, and other deciduous trees; there are also some white pines and hemlocks scattered through the forest, and a heavy undergrowth of mountain-laurel, striped maple, witch-hazel, and other shrubbery. The black-throated blue warblers and the veeries were the commonest breeding birds in this area.

Gerald Thayer wrote to Dr. Chapman (1907) that about Monadnock, N. H., this is "a bird of the ampler deciduous undergrowth in deep, moist woods—mixed virgin timber or very old second growth.

It is peculiarly partial to these woodland conditions, and is common wherever they occur, especially between the altitudes of 1,000 and 2,500 feet. Creeping yew is almost always common in woods where these Warblers breed, and they sometimes, perhaps often, nest in a clump of it." And William Brewster (1938) says that around Umbagog Lake, Maine, "the local population was chiefly concentrated wherever there were extensive patches of yew (*Taxus canadensis*)." I can find no evidence that this warbler is ever common in clear stands of coniferous trees, but is often found in mixed woods where there is a scattering of the evergreens, especially if there are small seedlings of spruce, fir, or hemlock, in which they sometimes build their nests.

Territory.—In favored regions, where the population is fairly dense, as it often is, the males arrive ahead of the females and establish their breeding and feeding territories, which they often have to defend against intruding males of the same species. John Burroughs (1895) describes such an encounter as follows: "Their battle-cry is a low, peculiar chirp, not very fierce, but bantering and confident. They quickly come to blows, but it is a very fantastic battle, and, as it would seem, indulged in more to satisfy their sense of honor than to hurt each other, for neither party gets the better of the other, and they separate a few paces and sing, and squeak, and challenge each other in a very happy frame of mind. The gauntlet is no sooner thrown down than it is again taken up by one or the other, and in the course of fifteen or twenty minues they have three or four encounters, separating a little, then provoked to return again like two cocks, till finally they withdrawn beyond hearing of each other,—both, no doubt, claimin the victory."

Nesting.—I believe that John Burroughs (1895) was the first naturalist to discover the nest of the "black-throated blue-backed warbler," as he called it, and he wrote an interesting account of his hunt for it in "Locusts and Wild Honey." It was found in July, 1871, in Delaware County, N. Y., and contained four young and one addled egg. "The nest was built in the fork of a little hemlock, about fifteen inches from the ground, and was a thick, firm structure, composed of the finer material of the woods, with a lining of very delicate roots or rootlets." The young birds were nearly fledged and were frightened from the nest. "This brought the parent birds on the scene in an agony of alarm. Their distress was pitiful. They threw themselves on the ground at our very feet, and fluttered, and cried, and trailed themselves before us, to draw us away from the place, or distract our attention from the helpless young."

Mrs. Harding showed me some half dozen nests of this warbler in the locality near her camp at Asquam Lake, N. H. All were in low bushes of mountain-laurel (*Kalmia latifolia*) from 12 to 18 inches above the ground and were not very well concealed. They were well made of strips of inner bark, canoe birch bark, straws, fern fronds, and dry leaves, and were lined with black horsehair and fine black rootlets. Altogether, Mrs. Harding (1931) found 15 nests similarly placed in low mountain-laurels, from 9 to 15 inches up, and all made of similar materials, but she says that "skunk fur is used freely as a substitute and sometimes pine needles or bits of moss," in the lining. So far as I know, she has not found pieces of rotten wood in the nests, as commonly reported by others.

Miss Cordelia J. Stanwood, of Ellsworth, Maine, tells me that the nests she finds near her home are placed in small firs or spruces. Frederic H. Kennard mentions in his notes a Maine nest wonderfully well hidden in a clump of little spruces about one foot from the ground. He also reports two Vermont nests, one about 2 feet from the ground in a tangle of raspberry vines beside a logging road, the other about 8 or 10 inches up in a little thicket of low-growing mountain maple. Robie W. Tufts tells me that the few nests he has examined in Nova Scotia were all built in "small spruce or fir seedlings two or three feet from the ground in heavy woods of mixed or coniferous growth."

Francis H. Allen writes to me of a nest he found in an unusual situation in Waterville, N. H.: "It was placed about a foot from the ground in the small twigs of a fallen beech, on which were the dead leaves of last season. * * * I collected the nest July 3 after the young had left it. The measurements were: Diameter, outside, 3½ inches; inside, 2 inches; depth, outside, 2¼ inches; inside, 1⅛ inches. It was composed mainly of fragments and shreds of dead wood, apparently stuck together by some glutinous substance, and in one place it had what seemed to be a web of some kind binding it. A few beech buds and bud scales were worked in, and a bleached leaf fragment, a shred of yellow birchbark, and a small dangling strip of canoe-birch paper—the last perhaps for ornament—completed the body of the nest. The lining was of fine black rootlets. The general effect of the outside was a light yellow or bright straw-color. It was an interesting and a beautiful nest."

Dr. Chapman (1907) says that "nests found by Burtch (MS.) at Branchport, New York, were built in birch saplings eighteen and twenty inches from the ground, and in a blackberry bush fourteen inches from the ground." He quotes from the manuscript of Egbert Bagg, of Utica, N. Y., who found nests very similar to the one described above by F. H. Allen. But he says that "one nest had some of the finer quills of our common procupine (even large enough for their barbs to be visible to the naked eye). This sort of lining might be satisfactory to the old bird, protected by her coat of feathers, but would seem to be somewhat dangerous to her naked fledglings." One of his nests, evidently built in an upright fork, measured "diameter, outside, 3½ inches, inside, 2¼ inches; height, outside, 5 inches; depth, inside, 1½ inches."

T. E. McMullen has sent me the data for 22 nests, found in the Pocono Mountains, Pa. All of these were built in rhododendrons in woods, two on hillsides, one on the edge of a road, one on the edge of the woods, one near a creek, and three along a creek bank. Most of Mr. Brewster's (1938) Lake Umbagog nests were placed low down in yews (*Taxus canadensis*). Apparently, the favorite nesting sites of the black-throated blue warbler are in the broadleaf evergreens, mountain-laurels and rhododendrons, where these are available; next in popularity come the other evergreens (spruces, firs, and hemlocks) of small size; but nests have been found in many places in deciduous seedlings, saplings and sprouts, mainly maple and beech, or in various other bushes or tangles.

Mrs. Harding gave me an account of the building of a nest, which she watched during a period of four days. Most of the work was done by the female, but the male helped shape the nest occasionally. The beginning of the nest and much of the main part of it was made of thin strips of the paperlike bark of the white, or canoe, birch firmly bound in place with great quantities of cobwebs; during the early stages of building the rim was anchored with several strands of cobweb to the surrounding leaves and twigs to secure it while the nest was being shaped; this the bird did by sitting in the nest and turning around in all directions, molding it inside with her feet and breast and pressing her tail down over the edge to smooth the exterior. The male sang in the vicinity and brought some of the material, and once he drove away another male. The nest was finished on the fourth day. This process is described in more detail in Mrs. Harding's (1931) paper, where she notes "there is usually an interim of at least twenty-four hours before the first egg is laid. The female lays the eggs at intervals of twenty-four hours—frequently early in the morning. * * * On the morning of the fourth day when the clutch is complete the female commences incubating."

Eggs.—The black-throated blue warbler lays normally four eggs, three are not a rare complement, but five are seldom found. Richard C. Harlow tells me that in over 200 nests that he has examined he has found only 4 sets of five.

The eggs vary in shape from ovate to short ovate, rarely tending to elongate ovate, and are only slightly lustrous. They are white or creamy white, speckled, blotched, or clouded with tones of "pecan brown," "russet," "Mars brown," "cinnamon-brown," "chestnut-brown," "bay," or "auburn," with undertones of "benzo brown," "light brownish drab," "light violet-gray," or "pale Quaker drab." There is quite a little variation in the markings, ranging from spots and undertones that are distinct and clearly defined to spots clouded together and undertones only faintly discernible. The markings are usually concentrated at the large end, often forming a loose wreath, or sometimes a solid cap of brown. Occasionally, markings are well scattered over the entire egg. There seem to be two distinct types, one having spots of two or three shades of brown, with gray undertones, the other with tones of only one shade of brown, with drab undertones. The measurements of 50 eggs average 16.9 by 12.8 millimeters; the eggs showing the four extremes measure **18.9** by 13.0, 16.7 by **13.5**, **15.2** by 12.2, and 17.0 by **11.8** millimeters (Harris).

Young.—The period of incubation for the black-throated blue warbler, according to Miss Stanwood's notes, is about 12 days; and the young remain in the nest for about 10 days. Incubation of the eggs and brooding of the young is done by the female only, but feeding the young and cleaning the nest is shared about equally with the male. She saw the young fed with daddy-longlegs, white moths, caterpillars, crane-flies, mosquitoes, and many other insects.

Quoting from the notes of J. A. Farley, Mr. Forbush (1929) gives the following picture of a brooding female: "She had spread the white feathers of her lower parts out so completely over her young that there was not a vestige now visible of the four young that I had found a short time previously filling the nest so full. She 'fluffed' herself out so as to hide all traces of the young. * * * She made a beautiful picture. The whole effect was wonderful. The bird seemed to be sitting in a billowy mass of eider down, or cotton wool, that swelled, or rather bulged, up all around her, a regular bed of down."

Mrs. Nice (1930b) watched a brood of young black-throated blue warblers, in Pelham, Mass., for 7 consecutive days, June 24 to 30, and for a total of 36½ hours. During this time the female fed the young 193 times and the male, 201 times; the average feeding time was once in 5.6 minutes; the female brooded 22 times, a total of 200 minutes, mainly in the earlier half of the period; the feces were eaten by the female 6 times and by the male 13 times; they were carried away by the female 47 times and by the male 67 times.

As to the food of the young, Mrs. Harding (1931) writes:

> As soon as the young hatch the female begins feeding them. I have seen no evidence of regurgitation. She thoroughly crushes caterpillars, etc., between her mandibles before giving them to the young. Their food for the first day consists of small insects, soft white grubs and a large number of half inch, smooth, green caterpillars, which are found on hemlock trees. From the second to the eighth day their diet consists chiefly of small green caterpillars, insects, white grubs and an occasional may-fly or gray and cream colored caterpillar without spines. On the ninth and tenth day their diet still includes white grubs

> and green caterpillars, but dragon flies and may-flies are the chief staples. Slugs, winged ants, white cabbage butterflies and moths are also on the menu.
>
> From the time the young hatch until they are five days old the parents swallow the faecal sacs. After that they carry them away from the nest and place them on the branches of neighboring trees—frequently using dead branches.

She gives a detailed account of the development of the young and their manner of leaving the nest naturally on the tenth day. During the 6 days when she thought it safe to handle them without driving them out of the nest too soon, one increased in weight from 22 grains to 141, and another from 24 to 147 grains.

Plumages.—The sexes differ slightly in the juvenal plumage. The young male is olive-brown above; the wings are blackish, the primaries edged with bluish-leaden-gray; the wing coverts, secondaries, and tertials are margined with olive-green, and there is a white patch near the base of the primaries, as in the adult; the tail is much like that of the adult; the under parts are brownish, tinged with yellowish on the throat and abdomen; the lores and two submalar streaks are dusky, and the superciliary stripe is yellowish white. The young female is similar, but has dull brown wings and tail with greenish instead of bluish edgings, and the white area in the primaries is smaller, more dingy and sometimes obscure.

A partial postjuvenal molt occurs in late July and August involving the contour plumage and the wing coverts but not the rest of the wings or the tail, producing a first winter plumage in which the sexes become decidedly differentiated and not very different from the adults at that season. This is one of the few wood warblers in which the fall plumage is very much like the spring dress. In the young male the blue of the upper parts is not as clearly blue as in the adult; the feathers of the back are faintly edged with olive-green, those of the black throat veiled with dull whitish, and the abdomen is tinged with yellowish. The young female differs from the fall adult in being greener above, without bluish tinge, and more buffy or yellowish below.

There is a limited prenuptial molt about the head, and wear has removed most of the edgings and fading has made the under parts clearer. At this age, young birds can be distinguished from adults by the worn and dull brown wings and tail. Subsequent molts and plumages, in which young and old are alike, consist of a complete postnuptial molt in July and August and a limited prenuptial molt about the head. The adult male in the fall is only slightly tipped with greenish above and with whitish on the black throat, which may be somewhat less in extent.

Food.—No thorough study of the food of the black-throated blue warbler seems to have been made, but probably all of the items mentioned as food for the young are also eaten by the adults. Forbush (1929) adds the hairy tent caterpillar, flies, beetles, and plant lice. Aughey (1878) found 23 locusts and 15 other insects in one stomach collected in Nebraska. Dr. Wetmore (1916) reports on the contents of eight stomachs collected in Puerto Rico, in which animal matter formed 75.5 percent and vegetable matter 24.5 percent of the food. "The vegetable food was found in the three stomachs taken in December and January and consisted of seeds of the camacey (*Miconia prasina*)." The principal items in the animal food were lantern flies (Fulgoridae), 19.46 percent, various weevils, 14.25 percent, flies, 10.09 percent, and spiders, 12.62 percent. A few beetles and one ant were eaten. Most of the food consisted of harmful insects.

Behavoir.—The black-throated blue warbler is one of the tamest and most confiding of all our wood warblers. I was able to photograph (pl. 30) the female incubating and both sexes feeding the young at very short range without any special concealment; they are very devoted parents and show great concern when the safety of their young is threatened, trailing along the ground with the broken-wing act in great distress.

Gerald Thayer wrote to Dr. Chapman (1907): "In its movements the Black-throated Blue is more deliberate than many of its relatives, but it has at the same time a somewhat Redstart-like way of 'spiriting' itself from one perch to another, and, while perched, of partly opening its white-mooned wings;—a habit and a marking shared by the boldly blue-and-black-and-white males and the dimly green and yellowish females and young."

Henry D. Minot (1877) writes:

> They are very dexterous in obtaining their insect prey; sometimes seizing it in the air, with the skill of a true Flycatcher, and at other times finding it among the branches of the various trees which they frequent. Now they twist their heads into seemingly painful postures, the better to search the crannies in the bark or blossoms, now spring from a twig to snap up an insect in the foilage above their heads, instantly returning, and now flutter before a cluster of opening leaves, with the grace of a Hummingbird. Occasionally they descend to the ground, and are so very tame that once, when I was standing motionless, observing some Warblers near me, one hopped between my feet to pick up a morsel of food.

Voice.—Aretas A. Saunders has sent me the following study of the song: "The song of the black-throated blue warbler, in its more typical forms, is one of only three or four slowly drawled notes in a peculiarly husky voice, the last note commonly slurred upward. While the number of notes in the songs varies in my 41 records from two to seven, more than half of them are of only three notes, and most of the others are of four or five. In all, 22 songs end with the upward slur of the last note, 14 in an unslurred note and 5 in a downward slur.

The general trend of the pitch is upward in 29 records, downward in 10, and ending in the same pitch as the first note in 2.

"The pitch of songs varies from G‴ to E⁗, a range of four and a half tones. Single songs range from half a tone to three tones, the majority covering one and a half or two tones. The length of the songs is from 1⅕ to 2 seconds. This indicates the slowness of the three or four notes, for other warbler songs with twice as many notes are about the same length. In the few songs of this bird that have more notes the notes are shorter and faster, so that the songs are not longer.

"This species shows a greater tendency to sing unusual songs than most warblers. On three occasions I have heard a warbler song that I could not recognize, and when I located the bird, found it to be a black-throated blue.

"Two of these songs were of rapid notes, in a clear, ringing quality, not at all like the ordinary song of this bird. The third was two rather long notes in a clear, sweet whistle, the second higher in pitch than the first, so that it resembled the *phoebe* whistle of the chickadee reversed.

"The average date of the last song in 14 summers in Allegany State Park is July 21. The earliest is July 14, 1927 an 1940, and the latest July 29, 1931. The song is rarely revived in August, after the molt."

Francis H. Allen (MS.) writes the two common songs as "*quee quee quee-e-e′* " and "*que-que-que-que quee-ee′*," and says further, "in June 1907, I heard a bird in Shelburne, Vt., that sang persistently a short song like *kū quee-e-e′* besides singing occasionally one of the ordinary songs. In May, 1910, at Jaffrey, N. H., I heard a bird sing over and over *qui-qui-qui-qui-qui-qui-qui-qui-quee′*, but most of the birds of the region seemed to sing *zee zee zee-ee*, with a falling inflection, while some sang the ordinary *quee quee quee-e-e′*, with rising inflection. The *quee* songs have a nasal tone. The call note is a dry *chut* or *chet*, resembling the *chip* of the black-throated green but not so thick."

Mrs. Nice (1930b) describes four different songs; and Gerald Thayer, in Chapman (1907), gives four main songs, with variations, but the versatility of this singer seems to be well enough shown in the previous descriptions.

Field marks.—The male black-throated blue warbler could hardly be mistaken for anything else; there is no other American warbler that is at all like it. The blue back, the extensive black throat, the white patch near the bases of the primaries, the white under parts, and the white spots on the inner webs of the three outer tail feathers are all diagnostic. Fortunately, the fall plumage is essentially the same. But the female is one of the most difficult of the warblers to recognize, olive-green above and buffy below; the only distinctive marks are the white patches in the wings and tail, similar to those of the male, but smaller, duller, and sometimes obscure.

Fall.—As soon as the molting season is over, late in August, old and young birds begin to drift away from their summer haunts; most of them depart from New England during September or even late August. Birds from New England and farther north pass through the Atlantic Coast States to Florida and the West Indies, while those from the interior migrate slightly southeastward and across the lower Alleghenies to join them. Professor Cooke (1904) writes:

> "Black-throated blue warblers strike the lighthouse at Sombrero Key in greater numbers than any other kind of bird, particularly during the fall migration. * * * In five years' time they struck the light on seventy-seven nights, and as a result 450 dead birds were picked up on the platform under the lantern. Probably a still larger number fell into the sea. Adding to these those that were merely stunned and that remained on the balcony under the light until able to resume their journey, the keeper counted 2,000 birds that struck. There were two nights, however, when the numbers of this species were so great that no attempt was made to count them. The Fowey Rocks lighthouse was struck on thirty different nights. It is certain, therefore, that the black-throated blue warbler passes in enormous numbers along both coasts of southern Florida.

Winter.—Professor Cooke (1904) observes that "the winter home of the black-throated blue warbler is better defined than that of any other common warbler, and allows a very exact determination of the square miles of territory occupied by it at this season. Cuba, Haiti, and Jamaica, with a combined area of 74,000 square miles, are doubtless occupied during the winter by the great majority of the individuals of the species. The remaining birds do not probably cover enough territory to bring the total to 80,000 square miles. This is a small area compared with that occupied during the breeding season." In his Birds of Cuba, Dr. Thomas Barbour (1923) writes:

> The Black-throated Blue Warbler is excessively common, early to arrive and late to leave. It is one of the tamest and most confiding species, and one to be found in all sorts of situations. Early pleasant days in Cuba spent at Edwin Atkins' plantation, Soledad, near Cienfuegos, brought a great surprise, for I found it not uncommon to have these little Warblers enter my room through the great ever open windows and flit from couch to chair. This happened often, notably at Guabairo, not far from Soledad. So inquisitive and confiding are they, that one can hardly recognize the rather retiring dweller in woodland solitude which we know in the North.

DISTRIBUTION

Range.—Eastern North America, from southern Canada to northern South America.

Breeding range.—The black-throated blue warbler breeds **north** to southwestern and central Ontario (Lac Seul, Kapuskasing, and Lake

Timiskaming); and southern Quebec (Blue Sea Lake, Quebec, Godbout, and Mingan). **East** to southern Quebec (Mingan, Grand Grève, and the Magdalen Islands); eastern Nova Scotia (Cape Breton Island and Halifax); southern Maine (Ellsworth and Auburn); southeastern Massachusetts (Taunton); Connecticut (Hadlyme); northeastern Pennsylvania (Lords Valley and Pocono Mountain); and southward through the Alleghanies to Northwestern South Carolina (Mountain Rest); northeastern Georgia (Rabun Bald, Brasstown Bald, and Young Harris). **South** to northern Georgia (Young Harris); southeastern Tennessee (Beersheba Springs); southeastern Kentucky (Log Mountain and Black Mountain); northeastern Ohio (Wayne Township and Pymatuning Bog); northern Michigan (Douglas Lake and Wequetonsing); northern Wisconsin (Fish Creek, Mamie Lake, and Perkinstown); and northern Minnesota (Kingsdale, Cass Lake, and White Earth; possibly sometimes near Minneapolis). **West** to northern Minnesota (White Earth) and western Ontario (Lac Seul). The species very probably breeds rarely in Manitoba or Saskatchewan where there are as yet only a few records and it is a recent arrival. At Emma Lake, Saskatchewan, 40 miles north of Prince Albert, 5 were observed June 27 to July 2, 1939. The first record for the Province was a specimen collected on October 21, 1936, at Percival, 100 miles east of Regina. It is a rare but tolerably regular migrant through eastern North and South Dakota, suggesting that there is some as yet unknown breeding area. The species has been recorded in migration, more often in fall, in Wyoming, Colorado, Nebraska, Kansas, Oklahoma, and Texas.

Observers at Aweme, Manitoba, in 38 years recorded it only twice. Another observer at Eastend, southwestern Saskatchewan, recorded it for the first time on September 21, 1937, after at least twenty years of continuous observation.

On the basis of such information it seems probable that the species is slowly spreading its breeding range westward.

Winter range.—The principal winter home of the black-throated blue warbler is in the West Indies where it is found **north** to the Bahamas (Andros, Nassau, and Watling Islands). **East** to Puerto Rico (Río Piedras) and the Virgin Islands (St. Croix). **South** to Puerto Rico (Maricas); Hispaniola (Paraíso, Dominican Republic; and Jérémie, Haiti); Jamaica (Spanishtown); and the Swan Islands. **West** to the Swan Islands; Cozumel Island; Cuba (Habana); and the Bahamas (Andros). It is also casual north to southern Florida (Sanibel Island, Key West, and Sombrero Key); accidental in Guatemala (Cobán); and in northern South America; Venezuela (Ocumare and Rancho Grande); and Cclombia (Las Nubes, Santa Marta region, and Pueblo Viejo).

The species as outlined is divided into two subspecies or geographic races. The black-throated blue warbler (*D. c. caerulescens*) is found in Canada and in the United States south to Pennsylvania; Cairns' warbler (*D. c. cairnsi*) breeds in the Appalachian Mountains from southwestern Pennsylvania southward.

Migration.—Late dates of departure from the winter home are: Puerto Rico—Consumo, April 3. Haiti—Morne à Cabrits, May 6. Cuba—Habana, May 11. Bahamas—Cay Lobos, May 14.

Early dates of spring arrival are: Florida—Fort Myers, March 4. Georgia—Fitzgerald, April 11. South Carolina—Spartanburg, April 5. North Carolina—Weaverville, April 19. Virginia—Lynchburg, April 21. District of Columbia—Washington, April 19. Pennsylvania—Swarthmore, April 25. New York—New York, April 28. Massachusetts—Amherst, May 2. New Hampshire—East Westmoreland, April 29. Maine—Auburn, May 3. Novia Scotia—Scotch Lake, May 7. Quebec—Quebec, May 7. Louisiana—New Orleans, March 22. Tennessee—Chattanooga, April 14. Kentucky—Lexington, April 24. Illinois—Urbana, April 26. Ohio—Canton, April 22. Michigan—Battle Creek, April 28. Ontario—Reaboro, May 3. Missouri—St. Louis, April 18. Iowa—Sigourney, April 21. Wisconsin—Ripon, April 28. Minnesota—Hibbing, May 8.

Late dates of the departure of transients in spring are: Florida—Daytona Beach, May 21. Georgia—Darien, May 20. South Carolina—Clemson (College), May 15. North Carolina—Raleigh, May 19. Virginia—Charlottesville, May 22. District of Columbia—Washington, May 30. Pennsylvania—Berwyn, June 3. Ohio—Ashtabula, May 29. Indiana—Fort Wayne, June 2. Michigan—Detroit, June 2. Illinois—Lake Forest, June 8. Wisconsin—Racine, June 4. Iowa—National, May 27.

Late dates of fall departure are: North Dakota—Fargo, October 21 (bird banded). Minnesota—Minneapolis, October 3. Wisconsin—Milwaukee, October 16. Iowa—Sigourney, October 20. Illinois—Chicago, October 25. Michigan—Grand Rapids, November 1. Indiana—Indianapolis, October 14. Ontario—Port Dover, October 27. Ohio—Medina, October 30. Kentucky—Eubank, October 22. Tennessee—Athens, October 18. Mississippi—Gulfport, October 12. Quebec—Montreal, October 15. New Brunswick—Saint John, October 11. Maine—Portland, October 17. New Hampshire—Water Village, October 8. Massachusetts—Cambridge, November 7. New York—Fire Island, October 24. Pennsylvania—Harrisburg, October 24. District of Columbia—Washington, October 29. Virginia—Lexington, October 15. North Carolina—Highlands, November 14. South Carolina—Clemson (College), October 17. Georgia—Athens, November 2. Florida—Fernandina, November 15.

Early dates of fall arrival are: Wisconsin—New London, August 23. Michigan—Grand Rapids, August 26. Ohio—Toledo, August 24. Illinois—La Grange, August 24. District of Columbia—Washington, August 21. Virginia—Charlottesville, September 12. North Carolina—Mount Mitchell, September 1. South Carolina—Mount Pleasant, August 30. Georgia—Savannah, August 28. Florida—Coconut Grove, August 29. Cuba—Cienfuegos, September 2. Dominican Republic—El Río, October 5. Puerto Rico—Las Marías, October 12.

Casual records.—On the Farallon Islands, Calif., a specimen was found dead on November 17, 1886; it had been previously observed for three weeks. In New Mexico a specimen was taken at Gallinas Mountain on October 8, 1904, and on October 9, 1938 another was collected in Milk Ranch Canyon near Fort Wingate. In Bermuda a specimen was collected October 2, 1902; and it is considered a rare winter visitor. An individual spending the winter at a feeding stand in the suburbs of Washington, D. C., was observed closely from December 22, 1930, to January 16, 1931.

At sea the black-throated blue warbler has been observed on October 27, 1921, 12 hours run out from Port-au-Prince, Haiti, toward New York; and on March 29, 1918, in the Gulf of Mexico, 125 miles from Sabine Pass, La.

Destruction at lighthouses.—Lighthouses with fixed white lights have caused considerable destruction of bird life during migration and the black-throated blue warbler seems to have been especially lured to those in southern Florida. Records were received from several of these lighthouses over a period of 5 or 6 years. Those from Sombrero Key are most detailed and give an interesting picture of migration at that point, since they include date, weather conditions, number of birds that struck, number killed, and hours during which the birds struck the light.

Comparatively fewer birds struck the light in spring than in fall. The spring dates are from March 9 to May 29; but in 4 years birds are reported to have struck the light only on 24 nights and 4 individuals is the greatest number reported.

In the fall, the records extend from September 3 to December 5, the heaviest nights being from the middle of September to late October. In two different years birds struck the light on 19 nights in two months. The greatest number in one night was 400 with 56 killed. In one of those years 1146 birds struck the light; of these 193 were killed. It was not only on stormy nights that the birds were attracted, as 130 struck and 15 were killed on a night described as calm and dark. Sometimes they kept striking all night, but on others the flight seems to have been concentrated, as when 300 birds struck in 3½ hours. On a few occasions the mortality was as high as one-third of the birds that struck.

On the night of January 26, 1886, two birds struck the light. These were either wintering birds or extremely early migrants.

Egg dates.—Massachusetts: 6 records, May 28 to July 5; 3 records, June 2 to 8.

New Hampshire: 17 records, June 3 to 22; 9 records, June 10 to 15.

New York: 51 records, May 29 to June 20; 37 records, June 3 to 12, indicating the height of the season.

Pennsylvania: 57 records, May 25 to June 26; 32 records, May 30 to June 6.

North Carolina: 10 records, May 5 to June 22; 6 records, June 4 to 11.

Virginia: 19 records, May 26 to June 18; 14 records, May 27 to June 4 (Harris).

DENDROICA CAERULESCENS CAIRNSI Coues

CAIRNS' WARBLER

PLATE 31

HABITS

This local race of the black-throated blue warbler, breeding in the southern Alleghenies, was named by Dr. Elliott Coues (1897) in honor of its discoverer and original describer, John S. Cairns of Weaverville, N. C. Dr. Coues, at that time, mentioned only the characters of the male, but those of the female are fully as well, perhaps more satisfactorily, marked than those of the male. Ridgway (1902) describes both very well and concisely as follows:

"Similar to *D. c. caerulescens*, but adult male darker above, especially the pileum, which is not lighter blue than the back, the latter usually more or less spotted or clouded with black, sometimes chiefly black, the pileum sometimes streaked with black; adult female darker and duller olive above and less yellowish beneath, with the olive of flanks darker and more strongly contrasted with the pale olive-yellowish of abdomen." In discussing its distribution, he was unable to define its breeding range with any degree of accuracy; and adds in a footnote: "On the whole, the form is not a very satisfactory one, one of the two characters on which it was based (smaller size) failing altogether (*D. c. cairnsi* averaging slightly larger, in fact, than *D. c. caerulescens*), and the other only partially so, since many specimens of *D. c. cairnsi* have little if any black on the back, while many of *D. c. caerulescens* have quite as much as the average amount shown in *D. c. cairnsi*."

The 1931 A. O. U. Check-List gives the breeding range of *cairnsi* as from Maryland to Georgia, but no definite line can be drawn; birds from southern Pennsylvania and Maryland, and perhaps the Virginias, are variably intermediate in their characters, and specimens can be found that are referable to either one or the other form.

Before this race had been separated from the northern form, Cairns (1896) wrote of its haunts:

> High up on the heavily timbered mountain ranges of western North Carolina is the summer home of the Black-throated Blue Warbler.
>
> Here in precipitous ravines, amid tangled vines and moss-covered logs, where the sun's rays never penetrate the rank vegetation and the air is always cool, dwells the happy little creature, filling the woods from dawn to twilight with its song. * * *
>
> These birds are a local race; breeding from one generation to another. They arrive from the south nearly ten days earlier than those that pass through the valleys on their northward migration. It is common to observe migrants through the valleys while breeders on the higher mountains are already nest-building and rearing their young.

This statement agrees with Professor Cooke's (1904) later data, and with his statement: "The species is one of the few that appear in the mountains earlier than on the plains, and the case seems to sustain the theory that the individuals of a species that breed farthest south are the first to migrate in the spring."

Nesting.—Cairns (1896) writes on this subject:

> Nesting begins in May and continues until the end of June. The nests are placed in various shrubs, such as laurel, wild gooseberry, and chestnut, but the blue cohosh or papoose-root (*Caulophyllum thalictroides*) seems to be the favorite. These thick weeds grow rapidly to a height of from three to five feet, entirely hiding the ground, and thus afford the birds considerable protection. * * * The nests are never placed over three feet from the ground; usually about eighteen inches; one I examined was only six inches. * * *
>
> The nests show little variation in their construction, though some are more substantially built than others. Exteriorly they are composed of rhododendron or grape-vine bark, interwoven with birch-bark, moss, spider-webs, and occasionally bits of rotten wood. The interior is neatly lined with hair-like moss, resembling fine black roots, mixed with a few sprays of bright red moss, forming a strikingly beautiful contrast to the pearly eggs. The female gathers all the materials, and builds rapidly, usually completing a nest in from four to six days if the weather is favorable. She is usually accompanied by the male, which, however, does not assist her in any way.

Bruce P. Tyler of Johnson City, Tenn., has sent me some fine photographs (pl. 31) of the nests of this warbler, and says in his notes: "The Cairns warbler is found breeding in May, and later, on the southerly slope of Beech Mountain, just across the Tennessee line in North Carolina, at an elevation of 4,800 to 5,200 feet above sea level. The nest is built in small upright saplings or sprouts, 3 to 4 feet above the ground, and is constructed of shredded bark from the dying chestnut trees, rotten wood, etc., bound together with spiders' webs, and lined with fern rootlets and fine grass."

Thomas D. Burleigh (1927a) records four nests found, during May and June, on the slopes of Brasstown Bald in the northeastern part of Georgia: Two of these were in laurel bushes, 2 and 2½ feet from the ground; another was 2 feet up in the fork of a small viburnum; and the fourth was 5 feet from the ground, "saddled near the end of a drooping limb of a rhododendron at the base of a large yellow birch well up the mountainside." A nest in my collection was taken by H. H. Bailey in Giles County, Va., at an elevation of 4,000 feet, on May 22, 1914; it was placed in a horsechestnut sprout alongside of a road, 1 foot above the ground. This and another nest before me are very similar to those described above.

Eggs.—The 3 or 4 eggs laid by Cairn's warbler are practically indistinguishable from those of the black-throated blue warbler. The measurements of 30 eggs average 17.3 by 12.7 millimeters; the eggs showing the four extremes measure **19.0** by 13.0, 17.9 by **13.4**, and **16.0** by **12.0** millimeters (Harris).

DENDROICA CORONATA CORONATA (Linnaeus)

EASTERN MYRTLE WARBLER

Plates 31–33

HABITS

We used to call this the yellow-rumped warbler, a none too distinctive name, as other warblers have yellow rumps. Another early and slightly better name, "yellow-crowned wood warbler," reflected the scientific name *coronata* and was based on the old Edwards name "golden-crowned fly-catcher." The present name, Eastern myrtle warbler, comes from its fondness for the berries of the waxmyrtle (*Myrica cerifera*); and in the south, where it is common in winter, it is often called the myrtlebird.

Next to the yellow warbler, this is probably the best known of the wood warblers and is about the second one of the group that the novice learns to recognize. All through the eastern United States this is by far the most abundant warbler on both migrations, being about the first to arrive in the spring and the last to leave in the fall, often remaining all winter nearly up to the southern limits of its breeding range. It is a large, conspicuous warbler, not at all shy, and is to be found almost anywhere, often in enormous numbers. The breeding range of the species is one of the most extensive, extending from the tree limit in Alaska and northern Canada down through the coniferous forests into the northern tier of States, and even farther south in the mountains. Its winter range is still more extensive. It spends the winter farther north than any other wood warbler, although more or less sparingly and irregularly in the northern States, and its range extends through the Bahamas, the northern West Indies, Mexico, and Central America to Panamá. There is no wonder that it is well known. But neither Wilson, Audubon, nor Nuttall ever found its nest.

Spring.—Professor Cooke (1904) writes:

> The myrtle warbler is one of the first migrants to move northward. A large flight struck the Alligator Reef lighthouse February 23, 1892, and some 60 birds struck the Sombrero Key lighthouse March 3, 1889. By the middle of March migration is well under way over all the winter range, and the foremost birds keep close behind the disappearance of frost. * * * By the last of March all the myrtle warblers have departed from Jamaica, Haiti, Cuba, and the Bahamas. The latest recorded date of striking of this species at any of the Florida lighthouses is April 3, 1889. By the middle of the month the latest northbound birds have left southern Florida. * * * Most of the migrants cross the Rio Grande into Texas about the middle of March, and it is the middle of April before the last have passed north.

Charles L. Whittle (1922) witnessed a heavy migration of myrtle warblers along the coastal islands of South Carolina on March 4, 1920, that seemed to have been influenced largely by the presence of the waxmyrtle (*Myrica cerifera*). He says:

> Perhaps half a mile from the northeast end of Sullivan Island the belt of waxmyrtle trees narrows to a width, measured northwest and southeast, of about three hundred feet. Here, near a seashore resort, a road had been recently cut across the belt of waxmyrtle trees at right angles to the sand bar. Streams of warblers flying along the shore northeasterly from Folly and Morris Islands, just south of the entrance to Charleston harbor, dropped to the land and converged at the southwest end of the mantle of myrtle trees and passed across the open swath cut for the new road. Posting ourselves here we counted the birds moving northeast, minute by minute as they passed the opening, for half an hour. The flight was continuous, many of the birds lighting on the ground and trees from time to time, and the number crossing per minute varied from twenty to two hundred, and accordingly averaged about one hundred per minute. As far as we could judge the number was no greater than it had been all the time since our arrival at the shore. Taking, therefore, the average at one hundred per minute, 24,000 Myrtle Warblers passed northward between nine in the morning and one in the afternoon. Not only so, but additional warblers passed close by both to the east and to the west of the stream of birds under observation. No doubt also the migration began prior to nine in the morning and did not cease at one in the afternoon.

He points out that the northern species of myrtle, or bayberry (*Myrica pensylvanica*), extends all along the coast from New Brunswick and Nova Scotia to Florida; and he suggests that if these warblers prefer to migrate along a coastal route where these myrtles reach their maximum development and where the climate may be milder than at higher elevations inland, it may explain why they generally arrive in New Brunswick a week earlier than in Pennsylvania.

Milton P. Skinner (1928) says that, in the North Carolina sandhills, "early in March the movement becomes conspicuous, and great numbers of these warblers are then seen constantly moving through the forests and across the fields in steady streams, flitting about a few minutes, and then passing on to the northeast. These movements are near the ground, or among the tree trunks, but at other times the birds are above the tallest trees. The general direction is from the southwest to the northeast, with fifty to a hundred warblers passing over a field each hour of every day for at least two weeks."

At Buckeye Lake, Ohio, according to Milton B. Trautman (1940)—

> No warbler species migrated through the area in such consistently large numbers as did the Myrtle Warbler, and none had a more prolonged spring or fall migration. The first spring transients, mostly brilliant colored males, were generally seen between April 12 and 20. Thereafter the number of individuals increased rapidly, and from May 1 to May 5 between 100 and 200 birds, mostly males, could generally be daily noted. A marked decrease usually followed this migration wave. Between May 10 and 18, during the period of maximum numbers for most warbler species, there was a second large wave and then 150 to 500, mostly females and young males, were observed daily. A drastic decline in numbers took place shortly after May 18, and by May 23 few or none remained.

The migration is about the same in Massachusetts. The birds come in waves, the adult males preceding the females. We usually see the first arrivals about the middle of April, drifting through the leafless treetops in the tall deciduous woods where we look for hawks' nests; in their brilliant new plumage with gleaming yellow patches they are easily recognized as myrtle warblers, even in the tops of the 60-foot trees. Mr. Forbush (1929) gives this picture of the later waves:

> In the latter days of April or very early in May when the south wind blows, when houstonias and violets begin to bloom on sunny southern slopes, when the wild cherry and apples trees and some of the birches, sumacs and the shrubbery in sheltered sunny nooks begin to put out a misty greenery of tiny leaflets, then we may look for the Myrtle Warblers, the males lovely in their nuptial dress of blue-gray, black, white and lemon-yellow. Then they may be found fluttering about in sheltered bushy bogs, catching the early insects that dance in the sunshine along the water-side. All through early May they move northward, or westward toward the mountains, migrating by day or night indifferently as the case may be.

Soon most of them have passed beyond our borders and reached their summer homes in the coniferous forests of the Canadian Zone, the first of the family to come, close on the heels of retreating winter and while frost and snow still linger in the northern woods.

Courtship.—The courtship of the myrtle warbler must be a very pretty performance. Two brief accounts of it have been published: "As summer approaches the males begin their courtship of the females, following them about and displaying their beauties by fluffing out the feathers of their sides, raising their wings and erecting the feathers of the crown, so as to exhibit to the full their beautiful black and yellow markings. After much time spent in courting they mate, and at once look about for a nesting place" (Forbush, 1929). Males seeking mates "made advances to the female contingency, hopping from twig to twig with outspread wings, chipping and fluttering, now repulsed by the fair one, and now accepted by another one to whom advances were made, to finally spend a few days in a favorable spot and begin nest building" (Knight, 1908).

Nesting.—On August 1, 1907, at Clarkes Harbor, Nova Scotia, I found the first and only nest of the myrtle warbler that I have ever seen; it was about 15 feet from the ground on a horizontal branch of a large spruce tree, about 5 feet out from the trunk, and contained three young birds that were nearly fully feathered. Robie W. Tufts says in his Nova Scotia notes: "I have seen these nests built at varying heights from 5 to 50 feet high. One found on June 6, 1919, contained four slightly incubated eggs. It was placed close to the stem of a pine tree, near the top, about 50 feet up. My field experiences tend to support the theory that these birds normally raise two broods a year." He found one nest built in an apple tree in an orchard, of which he says: "Of the large number of nests of this species I have examined, this is the only one not built in a conifer."

There are two Nova Scotia nests of the myrtle warbler in the Thayer collection in Cambridge, both taken by H. F. Tufts. They are slightly different in composition and structure, but are probably fairly typical of the species. One, found saddled on a spruce limb 10 feet from the ground, is rather bulky and loosely built; the foundation and sides are made of fine coniferous twigs mixed on the bottom with grasses and rootlets and around the rim firmly interwoven with black horsehair, or perhaps moose hair, and finer rootlets; the cup is smoothly lined with finer hair and feathers. Externally it measures, roughly, 4 by 5 inches in diameter and about 2 inches in height; the cup is about 2 inches in diameter and 1¾ inches deep. The other, a very pretty nest found 8 feet up in a small spruce, close to the trunk, is more firmly and compactly built; the base and sides are made up mainly of green mosses and a few gray lichens mixed with fine twigs and a few fine grasses, all firmly interwoven; internally the cup is smoothly lined with fine black and white hairs on top of a few feathers. Externally it measures 2¼ inches in height and 3 by 3½ inches in diameter; the cup is 2 inches in diameter and about 1½ inches deep.

Of nestings in Maine, Knight (1908) says: "As soon as nest building begins, the favorite locality selected is a thicket of evergreen trees near the highway, some open pasture containing a few clumps of scattered evergreens, small thickets of evergreens along the banks of some stream or river or about the shore of a pond or lake, or a row of trees about some country dwelling or in an orchard. In the vast majority of cases an evergreen tree is selected as a nesting site, though occasionally some hardwood tree, such as maple, apple or birch, may be taken. A majority of nests seem to be placed in cedar trees, with fir and spruce following as close second choices."

Forbush (1929) mentions two Massachusetts nests in tall white pines. A nest studied by Mrs. Nice (1930a), at Pelham, Mass., was "six feet up in a small red cedar on a branch next to the trunk. It was a rather shallow affair, composed of cedar twigs and bark, plant fibers, a piece of string and pine needles, and was lined with a few horse hairs and many Ruffed Grouse feathers."

Dr. Paul Harrington has sent me his notes based on the study of 44 nests of the myrtle warbler in Simcoe County, Ontario. He says that the white pine is generally chosen as a nesting tree, the nests being placed from 6 to 40 feet up, averaging 15 feet; "28 nests were built on horizontal limbs about two-thirds out from the trunk, but none at the outermost end. They were conspicuous from below but not from above, as clumps of needles overhung them in such a way as to afford good protection." Of the remainder, 2 were built in the top clump of needles in young trees; 5 were in small spruces, the lowest 3 feet, the highest 15, and all on horizontal limbs, 3 near the trunk and 2 halfway out on the limb; 5 were about 15 feet up in crotches of small cedars; 3 were found in red pines, in the outermost clumps of needles 10 to 15 feet from the ground; and 1 nest was 6 feet up in a small balsam. He says that the nest is lined thickly with feathers and a few hairs. "The feathers are so placed that, as well as lining the nest, they form a screen over the inside when the bird is not sitting. This is done by the shafts of the feathers being woven or imbedded into the inside of the nest and the vane lying free." At Petawa he found these birds nesting in small jack pines.

Dr. F. A. E. Starr, in his notes from northern Ontario, also says that any conifers are suitable nesting sites: "I have found only one exception to the use of a conifer. This nest was built in a hawthorn, and when I collected the nest, the birds moved to a cedar." A. D. Henderson writes to me: "The myrtle warbler is a fairly numerous summer resident at Belvedere, Alberta, and in the Fort Assiniboine District. It nests mainly in the muskegs in tamarack and spruce trees, but occasionally in deciduous trees close to a muskeg." The nests are mostly from 10 to 15 feet up. One nest was in a jack pine, "in a bunchy growth at the end of a limb." Baird, Brewer, and Ridgway (1874) state that MacFarlane found nests on the ground in the Anderson River region.

Eggs.—Most observers agree that four or five eggs form the usual set for the myrtle warbler. Tufts (MS.) says that "five eggs are more commonly found than four." Dr. Starr says in his notes that "four eggs are rarely laid, two and three being the usual numbers, while sometimes only one is laid, along with those of the cowbird." This is probably an abnormal situation in which the cowbird fills the nest with its own eggs, leaving little room for those of the warbler.

The eggs are ovate to short ovate and slightly glossy. The ground color is creamy white and is speckled, spotted, or blotched with "auburn," "argus brown," "Brussels brown," "chestnut brown," or "cinnamon-brown," with undermarks of "light brownish drab," "vinaceous gray," or "purplish gray." Generally the spots are concentrated at the large end, forming a wreath, but some are marked all over and may also have a few scrawls of blackish brown. I think the handsomest are those having the rich creamy white ground almost immaculate except for a solid wreath, around the large end, of spots and blotches of the browns overlapping and intermingled with the undertones of gray, so that they resemble somewhat the eggs of the wood pewee. On lightly marked eggs the drab or gray spots are the most prominent. The measurements of 50 eggs average 17.5 by 13.3 millimeters; the eggs showing the four extremes measure 20.3 by 13.2, 17.9 by 14.8, 14.8 by 12.9, and 16.0 by 12.4 millimeters (Harris).

Young.—The incubation period for the myrtle warbler is from 12 to 13 days and the young remain in the nest normally from 12 to 14 days. Incubating the eggs and brooding the young is apparently done entirely by the female, but both parents are active in feeding the young and in cleaning the nest. Mrs. Nice (1930a), with the help of Miss Lucille Baker, watched a nest containing young for a total of 19 hours, over a period of 6 days. On the first day the female brooded 25 percent of the time, but less later on; the brooding periods averaged 9 minutes.

> A great deal of her energy was expended in delousing the nest—thirty-six minutes on July 28 and seventy-four minutes during the forenoon of the next day, but after that there was little trouble. Once, during thirteen minutes she made over 250 captures, all of which she ate. * * *
>
> The male brought food sixty times, the female forty-eight times, so that the young were fed once in 10.9 minutes. About one-third of the time the male brought two insects, while the female did so on about one-sixth of her trips. During the fourteen hours of observation, the male brought food once in every nineteen minutes, the female once in every twenty-eight minutes. During the last five and one-half hours, the male brought food once in twenty-two minutes, the female once in eighteen minutes. * * *
>
> Excreta were eaten by the female through July 29, but she carried one away at 7:05 P. M., July 28. She ate twelve sacs and carried eleven; her mate carried twenty-five and ate one. * * * He picked lice off his legs and gave them to the babies.

Mr. Knight (1908) says: "The female does most of the work of incubation, but on very rare and exceptional occasions I have found the male bird incubating and even engaged in song while on the nest. * * * The natal down rapidly dries and fluffs out on the young birds and is sepia-brown in color. At the end of six to seven days pin feathers begin to appear, and by the twelfth to fourteenth day the young are well advanced in their juvenal plumage and able to scramble out of the nest. Two to three days after leaving the nest they are able to essay short flights."

Plumages.—Mr. Knight (1908) refers to the natal down as sepia-brown. Dr. Dwight (1900) describes the juvenal plumage, in which the sexes are alike, as "above, the feathers centrally dull black, edged with drab and buffy brown, producing a streaked effect. Below, much whiter but similarly streaked, a tinge of pale primrose-yellow on the abdomen. Wings and tail dull black, edged with drab, palest on primaries and outer rectrices. Two very indistinct buffy white wing bands. Upper and lower eyelids with dull white spots."

The first winter plumage is acquired by a partial postjuvenal molt in August, which involves the contour plumage and the wing coverts, but not the rest of the wings or the tail. This plumage is entirely different from the juvenal and the sexes are only slightly differentiated. Dr. Dwight (1900) describes the young male as "above, sepia-brown, grayer on the back and obscurely streaked with black, the rump and a concealed crown spot lemon-yellow, the upper tail coverts black, broadly edged with plumbeous gray. Wing coverts black, plumbeous edged and tipped with white tinged with wood-brown forming two wing bands. Below, dull white, washed with pale buff on the throat and sides and obscurely streaked on the breast and sides with black, veiled by whitish edgings. Sides of breast with dull yellow patches. Incomplete orbital ring and faintly indicated superciliary stripe white or buffy." He says of the young female: "The black streaking of this dress is less obvious both above and below than in the male, the plumage everywhere is browner, and the crown patch very obscure."

The extensive prenuptial molt begins early, usually in March, before the birds have left their winter quarters; a few new feathers may be assumed even in late February but most of the molt occurs in April while the birds are migrating; it is, however, generally completed by the time the birds have reached their breeding grounds. Dr. Dwight (1900) says this molt "involves most of the body plumage and wing coverts, occasionally a tertiary but not the rest of the wings nor the tail. The black and gray of the upper surface, the white wing bars and the yellow crown and rump are new, some of the old upper tail coverts and a part of the feathers of the abdomen and crissum being retained in many cases, those of the back and elsewhere less often. Young and old become practically indistinguishable although the young usually have browner and more worn wings and tails, obvious in the primary coverts, but the differences are not absolute." In the female, "the first nuptial plumage is assumed by a restricted moult, leaving behind many brown feathers. The brown feathers of the lores and auriculars are assumed by moult."

The adult winter plumage is acquired by a complete postnuptial molt, beginning late in July. In the male, this "differs little from the first winter dress, but the wings and tail are blacker with brighter gray edgings, noticeable especially in the primary coverts. The back is usually grayer and the lower parts whiter, with broader streakings above and below." In the female there are similar differences, the adult winter female resembling the young male at that season. Adults have a complete postnuptial molt in July and a prenuptial molt as in the young birds.

Food.—Forbush (1929) sums up the food of this warbler very well as follows:

> The Myrtle Warbler is one of the few warblers that can subsist for long periods upon berries and seeds, although undoubtedly it prefers insects when it can get them. Along the coast during the milder winters there are many flies rising from the seaweed in sheltered spots on mild days even in January, and there are eggs of plant-lice and some hibernating insects to be found on the trees, but the principal food of the Myrtle Warbler in New England during the inclement season is the bayberry. They can exist, however, on the berries of the Virginia juniper or red cedar and these seem to form their principal food when wintering in the interior; berries of the Virginia creeper or woodbine, those of viburnums, honeysuckle, mountain ash, poison ivy, spikenard and dogwoods also serve to eke out the birds' bill of fare. In the maple sugar orchards in early spring they occasionally drink sweet sap from the trees. In the southern Atlantic states they take palmetto berries. North and south they also eat some seeds, particularly those of sunflower and goldenrod. During spring and summer they destroy thousands of caterpillars, small grubs and the larvae of saw-flies and various insects, leaf-beetles, dark-beetles, weevils, wood-borers, ants, scale insects, plant-lice and their eggs, including the woolly apple-tree aphis and the the common apple-leaf plant-louse, also grasshoppers and locusts, bugs, house-flies and other flies including caddice-flies, crane-flies, calcid-flies, ichneumon-flies and gnats, also spiders.

To the above comprehensive list there is little to be added, although wild cranberries and the berries of the poison sumac might have been included. Myrtle warblers are doubtless instrumental in spreading the seeds of poisonous species of *Rhus*, which is not to their credit; they also help to disseminate the red cedar, as they digest only the outer covering of these three and the bayberries. These warblers are often seen on the beaches and sand dunes eating the seeds of the beachgrass, or in open fields feeding on grass seed and doubtless various weed seeds. They frequent the fresh holes bored by sapsuckers to drink the flowing sap and eat the insects that are attracted to it. In Florida, in winter, they drink the juice of fallen oranges in the groves and even the broken oranges on the trees.

They are somewhat expert as flycatchers, taking mosquitos and gnats in the air. Knight (1908) writes: "During the fall months they enter the city gardens and orchards, climb over the roofs and along the gutters of houses, peering into every nook and cranny. They hover on beating wings about such crannies of the clapboards and finish where they may have spied some delicious, big fat spider, chrysalis or other delectable morsel, and such finds are speedily devoured. Now peering, now hovering, and now springing into the air after some winged insect, they stop about a building for a few hours or days, slowly but surely retreating southward."

Behavior.—Much of the behavior of this friendly little bird has been referred to in connection with its activities about our homes and gardens and its nesting habits. Tilford Moore tells me that "these birds seem to have a tendency toward 'creeperism,' in that they are often seen hanging to the bark of a vertical trunk or branch, and are usually on the larger branches rather than among the smaller twigs. They often flutter a lot when hanging to the bark." And Wendell Taber sends me this note: "On May 5, 1940, Richard Stackpole and I watched a flock in West Newbury, Mass. The birds were running about on the grass near a stream. Again, they would alight at the base of a tree and run up it several feet. I think all the birds that performed this feat were females. They were most deceptive, and we kept thinking we were seeing brown creepers until we put field glasses on them."

William Brewster (1938) writes of the behavior of a female about her nest, 35 feet from the ground in a hemlock: "The female Yellow-rump was sitting and for some time she absolutely refused to leave her eggs. Watrous first shook the branch and then with a long stick poked and shook smartly the twigs within an inch or two of her head. At length she hopped out of the nest and stood for a moment or more on its rim looking about her. Then she fluttered down towards the ground with quivering wings and wide spread tail, moving slowly and alighting several times on a branch or cluster of twigs where she would lie prostrate for a moment beating her wings feebly and simulating the movements of a wounded or otherwise disabled bird."

Dr. Stone (1937) describes the flight of the myrtle warbler very well:

> We soon learn to identify their rather jerky flight as they rise from the bushes, and with a series of short wing flips turn now to the right, now to the left, in their zigzag progress, rising somewhat with the beats, and falling in the intervals. Sometimes a bird will go but a short distance, flitting from bush to bush, while others will climb higher and higher in the air, drifting in their jerky way across the sky like wind-blown leaves. * * *
>
> As soon as a Myrtlebird alights on a bush there is a short, sharp flip of the tail, not a seesaw action, but one involving the body as well, and as it comes

to rest the head is drawn in and the plumage ruffled up making the outline more nearly globular, while the wings are dropped slightly so that their tips are a little below the base of the tail.

Francis H. Allen has sent me the following notes on the behavior of this species: "Aug. 27, 1915, Mt. Sunapee, N. H. On the summit of the mountain an immature myrtle warbler, very tame, flitted and hopped about on the ground, over moss and rocks, and in bushes and trees, feeding industriously on small insects. It seemed to pay no attention to my companion and me, and at one time hopped between us when we stood about 6 feet apart, and came within 2 feet of my outstretched hand as I held a crumb out towards it. I followed it about a little and found it quite fearless, except when I made a sudden movement. The bird could fly well and seemed perfectly well able to take care of itself.

"July 5, 1931, Mt. Whiteface, N. H. One or more were seen flying up fifty or a hundred feet above the tops of the low spruces and darting about up there after insects—doubtless the black flies which were abundant on the summit.

"Oct. 25, 1941, Plymouth, Mass. A sizable flock were feeding actively, flying back and forth across the narrow Eel River, feeding among foliage, catching flies and eating bayberries. One came within 6 feet of me and calmly ate bayberry after bayberry."

Voice.—Aretas A. Saunders contributes the following account of the songs: "The songs of the myrtle warbler show some differences from those heard from birds on migration or on the breeding grounds. The song in general is a series of short, rapid notes in a rather colorless simple, but musical quality. The number of notes, in my 41 records, varies from 7 to 21 and averages about 12. The songs heard on migration, however, average 11 while those on the breeding grounds average 14.

"The songs heard on migration are quite indefinite in form; the pitch rises and falls irregularly, and no two songs are much alike. An individual bird may sing many variations, each song it sings often being a little different from the others. The notes, however, are all about the same length and loudness, accented notes that stand out from the others being rare. This song shows indications of a somewhat primitive character.

"The song on the breeding grounds is somewhat more definite; the notes are often joined in 2-note phrases, the first note of each phrase higher in pitch than the second and each phrase successively higher, so that the song trends upward in pitch. This is true of 10 of my 13 records of the song on the breeding grounds in the Adirondacks. The other 3 have a slight downward trend. In addition to the more regular form, these songs have a somewhat brighter, livelier, and more musical sound than those heard on migration.

"Songs of this species vary from 1 to 2⅘ seconds in length. There are usually about seven notes per second. Only 3 of my records show any irregularity in the time of the notes, that is having some notes that are shorter or longer than the others. Pitch of the songs varies from F‴ to E⁗, a half tone less than an octave. Single songs vary from one to four and a half tones, averaging about two and a half tones; only 5 records are greater in range, and only 16 are less, nearly half of the records having the average range.

"Since the myrtle warbler winters in Connecticut, I am able to get the first dates of singing. In 30 years of records the average date is April 13; the earliest April 2, 1923, and the latest April 25, 1920. In the Adirondacks the last date of singing noted was July 31, 1926.

"The call-note, *tchick*, is louder than in most warblers. I found it pitched on D″. Another note is a fainter *tseet tseet*, usually doubled and pitched on F-sharp‴."

Francis H. Allen (MS.) describes the song in a different way as follows:

"The only syllabifications I find in my notes are of a bird heard at West Bridgewater, Vt., June 19, 1907, which sang *whee whee whee whee whee whee whee whee hew hew*, sometimes with three or even four *hews* at the end and sometimes with only one; and one of a bird at South Tamworth, N. H., July 23, 1942, whose song consisted of two trills, *ching ching ching ching ching weedle weedle weet.*

"The ordinary call-note is a hoarse *chep*, easily distinguished from the call of any other New England warbler. I have also heard occasionally a slight *tsip* or *tsit*, suggesting a chickadee. The feeding call of the young out of the nest is a rapid succession of several explosive *chips* or *pits* with a rolling quality—a sort of chatter or chippering."

On June 7, 1900, in Washington County, Maine, I recorded the song of the myrtle warbler as *wheedle wheedle wheedle wheedle wheedle*, repeated five to seven times so rapidly as to be hard to count and all on one key, usually ending abruptly but occasionally in a little trill.

Few writers have accorded the song of the myrtle warbler much praise, but Bradford Torrey (1885) pays it this tribute: "For music to be heard constantly, right under one's window, it could scarcely be improved: sweet, brief, and remarkably unobstrusive, without sharpness or emphasis; a trill not altogether unlike the pine-creeping warbler's, but less matter-of-fact and business-like. I used to listen to it before I rose in the morning, and it was to be heard at intervals all day long."

Field marks.—The male myrtle warbler in spring plumage is easily recognized at a considerable distance in its blue-gray, black, and white plumage, offset by conspicuous patches of bright yellow on rump, sides, and crown, and by the black sides and cheeks. The female is much duller and browner, the yellow being less conspicuous and the black cheeks lacking. Young birds and fall adults are much like the female, but the yellow rump, showing plainly as the bird flies away from the observer, will distinguish the species at any season or age.

Enemies.—So much of the breeding range of the myrtle warbler is beyond the normal breeding range of the cowbirds that, until recently, it was supposed to be largely free from the imposition of this parasite. When Dr. Friedmann (1929) published his book on the cowbirds he had only three records of such molestation, but more have turned up since, particularly in the Middle West where the ranges of the two species overlap considerably. Dr. Paul Harrington writes to me from Toronto: "Sixty-five percent of the nests examined contained eggs or young of the cowbird; it would not be exaggerating to say that two-thirds of the initial nests are parasitized. The egg or eggs of the cowbird are often deposited before the nest is completed, leading to many a deserted nest. Twice I have found a cowbird's egg imbedded, as so often happens in the yellow warbler's nest, but in both cases yet another was in the nest with the owner's. Twelve percent of the nests with eggs of the cowbird were deserted, but none in which the owner's eggs were also present. Generally but one of the parasite's eggs was found, occasionally two and rarely three."

Dr. F. A. E. Starr says in his notes from Ontario: "Occasionally, when a cowbird usurps a nest, the birds continue building till the cowbird's egg is imbedded. This is all in vain, however, as out of 30 nests, I have yet to find one which did not contain from one to three eggs of the cowbird." And A. D. Henderson mentions in his notes from Belvedere, Alberta, a nest that held five eggs of the myrtle warbler and one egg of the Nevada cowbird, and another nestful consisting of four eggs of the warbler and two of the cowbird. Probably very few young of the warbler are likely to survive in nests with young cowbirds, which means that this parasite must seriously interfere with the normal increase in the warbler population.

Harold S. Peters (1936) lists two lice, two flies, and two mites as external parasites on the myrtle warbler.

Fall.—The myrtle warbler is one of the latest of its family to move southward and is also one of the most leisurely in migration; the migration covers practically the whole of September and October and much of November, the earliest arrivals sometimes reaching the Gulf States before the last ones have left Canada. Abundant in the spring, it is much more so in the fall, when it can often be seen in enormous numbers. As the birds drift along southward, many stop along the way where food is abundant and some spend the winter at no great distance from the southern limits of the breeding range. In Massachusetts, we usually look for them during the latter half of September or during those golden October days when woods are ablaze with the gorgeous autumn colors. As we stroll along the sunny side of the woods on some bright morning after a frosty night, the air is full of pleasing bird music. The robins, now wild woodland birds, are twittering or uttering their wild autumn calls as they drift through the trees; the white-throated and the song sparrows, from the brushy thickets below, give forth their faint, sweet notes like soft echoes of their springtime songs; and the myrtle warblers mingle their distinctive call-notes with these other voices as they glean for aphids on the birches. In the open grassy fields and weed patches, too, we find many myrtle warblers associated with the scattered flocks of juncos and field and chipping sparrows, feeding on the ground. And later in the fall, we find them in the bayberry patches near the seacoast, or even on the salt marshes or among the sand dunes with the Ipswich and savanna sparrows.

Southward along the Atlantic coast the flight is heavy; Dr. Stone (1937) says that, at Cape May, N. J., "on October 13, 1913, Julian Potter encountered a great flight of Myrtle Warblers which he estimated at 3,000. * * * October 31, 1920, was a characteristic Myrtle Warbler day. All day long they were present in abundance. The air seemed full of them wherever one went. Thousands were flittering here and there in the dense growth of rusty Indian grass (*Andropogon*), in the bayberry thickets, in pine woods and in dune thickets."

From their breeding grounds in the northern interior these warblers continue to drift southward during October, not in compact flocks but straggling in a continuous stream, some alighting while others are moving on. In Ohio, according to Trautman (1940), "the numbers continued to increase rapidly until approximately October 5. Between October 5 and 20 the species was more numerous over the entire land area than it was at any other season, and thousands were daily present. It was particularly abundant on Cranberry Island, where it fed upon insects, cranberries, poison sumac, and other berries. On several occasions an estimated number between 1000 and 1200 individuals was seen within an hour on this island. After October 20 there was a rather gradual decline in numbers. By November 1, comparatively few remained, and in some years the birds had disappeared."

Winter.—The myrtle warbler winters abundantly throughout the southern half of the United States east of the Great Plains, commonly as far north as southeastern Kansas, southern Illinois, southern Indiana and northern New Jersey, and less commonly or rarely and irregularly farther north. It is the only one of the wood warblers that is hardy enough to brave the rigors of our northern winters amid ice and snow and sometimes zero temperatures.

Robert Ridgway (1889) writing of its winter habits in southern Illinois, says:

> It may often be seen in midwinter, when the ground is covered with snow, in the door-yards along with Snowbirds (*Junco hyemalis*), Tree Sparrows, and other familiar species, gleaning bread crumbs from the door-steps, or hunting for spiders or other insect tidbits in the nooks of the garden fence or the crevices in the bark of trees; and at evening, flying in considerable companies, to the sheltering branches of the thickest tree tops (preferably evergreens), where they pass the night. Not infrequently, however, they roost in odd nooks and crannies about the buildings, or even in holes in the straw- or hay-stacks, in the barn-yard. A favorite food of this species are the berries of the Poison-vine (*Rhus toxicodendron*), and during the early part of winter large numbers of them may be seen wherever vines of this species are abundant.

What few myrtle warblers remain in southern Massachusetts are usually to be found in situations similar to those frequented in late fall, especially near the coast where there is a good supply of bayberries and other berries. When this supply is exhausted they move elsewhere, though they can subsist to some extent on the seeds of the pitch pine, on grass seed, and on various weed seeds. In New Jersey, they are found in similar situations. Farther south they are abundant inland as well as on the coast, living in all kinds of environments—old fields, cultivated lands, thickets, brushy borders of the woodlands, and in woods of scrub oaks and pine. They are common to abundant on both coasts of Florida and in the interior and often come into the orange groves, to feed on the fallen oranges. A. H. Howell (1932) says: “Not infrequently they may be found in numbers on the Gulf beaches, or in reeds in the salt marshes of the coast or in the Everglades. They are partial to the borders of streams or sloughs, and sometimes venture out on the floating vegetation in rivers or lakes.”

The following is contributed by Dr. Alexander F. Skutch: “In December, 1932, it was vividly brought home to me how widely the myrtle warblers are spread over the earth during the winter months, and in what varied climates they dwell. On the ninth, a clear, cold, winter day, I met a small party of these yellow-rumped birds in a barren field at the edge of a woods in Maryland. On the twenty-fourth, I watched them fly above the tatters of melting snow in New Jersey, within view of the skyscrapers of New York. That afternoon I embarked upon a ship, and a week later arrived upon a banana plantation in Guatemala, where the air was balmy and the landscape vividly green, where snow and bleak winds seemed to belong to another world. Yet here, too, were myrtle warblers, hundreds of them, feeding in the open pastures and along the roadways, wherever the vegetation was not too dense, then rising up in compact flocks, wheeling and dropping together, moving always as though actuated by a true group spirit. During three days on that plantation, I met 23 kinds of winter visitants from the North; yet the myrtle warbler appeared to be the most abundant of them all: certainly, I saw far more of them than of any other migratory bird; yet this was in part because they foraged in more exposed places. Of all the warblers I found here, this was the only species that moved in flocks; for most of the wood warblers that winter in the Central American lowlands are strict individualists. It is also significant that of all the 23 species of wintering birds, this, the most abundant in December, was the only one then common that I had not recorded from February to June of the same year, when I passed 4 months studying the birds on that same plantation.

"Although it has been recorded from Central American localities as early as October and as late as April, the myrtle warbler is certainly most abundant as a winter visitant from November to March. All my own records from points in Guatemala, Honduras, and Costa Rica fall within these 5 months. It arrives later and departs earlier than warblers less tolerant of cold.

"The myrtle warbler winters in a variety of situations. At Puerto Castilla, on the northern coast of Honduras, I found these warblers abundant at the end of January, 1931. Here they foraged upon the lawns between the cottages, hopping rather than walking like waterthrushes, and when alarmed flew up to rest upon the broad fronds of the coconut palms that lined the sandy beach. At the other extreme, I have found them in mountain pastures, rarely as high as 8,500 feet above sea level. In the highlands, this bird is likely to be confused with the Audubon warbler, from the mountains of western United States, in similar dull winter attire. But the Audubon warbler, even at this season, wears five patches of yellow—on the crown, throat, both sides and rump—while the myrtle warbler shows only four, lacking that on the throat. The presence or absence of yellow on the throat is a distinguishing feature.

"At the end of December, 1937, I found myrtle warblers abundant in the vicinity of Buenos Aires de Osa, a hamlet in the lower Térraba Valley of Costa Rica, of interest to the bird-watcher because, although lying in a region covered by the heaviest lowland forest, it is surrounded by extensive open savannas which support a rather different bird-life. Here fork-tailed flycatchers were also abundant, roosting by night in some orange trees behind the padre's house, by day spreading in small flocks over the savannas, where they perched in the low bushes, only a few feet above the ground, and darted down to snatch up the insects they descried. It was surprising to find the myrtle warblers associating intimately with the flycatchers; just as, in the

Guatemalan highlands, I had found Audubon's warblers flocking with bluebirds. The myrtle warblers not only foraged about the bushes which served the flycatchers as watch-towers; but the two kinds of birds, so dissimilar in size and habits, changed their feeding grounds together. While I sometimes found the warblers alone, I saw them in company with the fork-tailed flycatchers too often for the association to be looked upon as accidental. I could not discover that either warbler or flycatcher derived any material advantage from the presence of the other. It seemed to be a case of pure sociability.

"Central American dates are: Guatemala—Motagua Valley, near Los Amates, December 31, 1932; Sierra de Tecpán, March 16, 1933; Finca Mocá, January 20–26, 1935; Nebaj (Griscom), April 27; La Primavera (Griscom), April 8. Honduras—Puerto Castilla, January 27, 1931; Tela (Peters), March 17. Costa Rica—Vara Blanca, December 13, 1937, to February 28, 1938; Guayabo (Ridgway and Zeledón), March 18; Carrillo (Underwood), October 2; Guacimo (Carriker), December 4; Las Cañas, Guanacaste, November 21, 1936; El General, January 12, 1936; Buenos Aires de Osa, December 24–30, 1937."

DISTRIBUTION

Range.—North America.

Breeding range.—The myrtle warbler breeds **north** to northern Alaska (Kobuk River and timberline on the south slope of the Brooks Range); northern Yukon (La Pierre House); northern Mackenzie (Aklavik; Fort Anderson; MacTavish Bay, Bear Lake; Lake Hardisty, and Artillery Lake); northern Manitoba (Lac du Brochet, Cochrane River, and Churchill); northern Ontario (Moose Factory); southern Labrador (Grand Falls and Rigolet, possibly Nain and Okkak). **East** to eastern Labrador (Rigolet and Cartwright); Newfoundland (St. Anthony, Canada Bay, and St. John's); and Nova Scotia (Cape Breton Island, Sable Island, Halifax, and Yarmouth). **South** to southern Nova Scotia (Yarmouth); New Brunswick (Grand Manan); southern Maine (Gouldsboro, Deer Isle, Bath, and Auburn); New Hampshire (Concord); central and southern Massachusetts (Marlboro, Webster, and Pelham); southwestern Vermont (Bennington); northern New York (Falls Pond and Buffalo); rarely northeastern Pennsylvania (Pocono Lake); accidentally in northern Maryland (Havre de Grace); southern Ontario (London and Sarnia); northern Michigan (Crawford County and Douglas Lake); northern Wisconsin (Antigo, probably, Trout Lake, Namekagon Lake, and Superior); central Minnesota (St. Cloud, Brainerd, and Bemidji); southern Manitoba (Winnipeg and Aweme); central Saskatchewan (Flotten Lake and Prince Albert); central Alberta (Flagstaff, Camrose, Lobstick River, and Wipiti River); northern British Columbia

(Fort St. John, Ingenika River, and Buckley Lake); and southern Alaska (Admiralty Island, Sitka, Seldovia, and Nushagak). **West** to western Alaska (Nushagak, Russian Mission, St. Michael, and the Kobuk River).

Winter range.—The myrtle warbler winters in two discontinuous areas. The principal winter home is **north** to central Oklahoma (Oklahoma City); northern Arkansas (Winslow, Little Rock, and Helena); western Tennessee (Memphis); southern Illinois (Anna and Mount Carmel); southern Kentucky (Bowling Green); central Virginia (Lexington); District of Columbia (Washington); southeastern Pennsylvania (Philadelphia); northern New Jersey (Morristown and Elizabeth); southern Connecticut (New Haven); Rhode Island (Providence); and northeastern Massachusetts (Cape Ann). It also occurs in winter irregularly **north** to Holly, Colo.; Hays and Manhattan, Kan.; Madison, Wis.; Chicago, Ill.; Battle Creek and Rochester (one banded in January), Mich.; Rochester, N. Y.; and Portland, Maine. **East** to Massachusetts (Cape Ann) and along the Atlantic coast to Florida (Miami and Key West); the Bahama Islands (Little Abaco and Caicos); Dominican Republic (Puerto Plato and Sánchez); Puerto Rico (San Juan); St. Croix Island; and rarely, Antigua. **South** to Antigua, northern Colombia, rare or accidental (Santa Marta region); and Panamá (Pearl Islands). **West** to Panamá (Pearl Islands, Canal Zone, and Almirante); Costa Rica (El General and Guayabo); eastern Nicaragua (Greytown and the Río Escondido); northern Honduras (Puerto Castilla and Lancetilla); western Guatemala (Dueñas and Tecpán); eastern Oaxaca (Tehuantepec); Veracruz (Orizaba); Tamaulipas (Victoria); Nuevo León (Monterrey); southwestern Texas (mouth of the Pecos River, Camp Barkeley, Taylor County, and Fort Worth); and central Oklahoma (Oklahoma City).

The western winter range is **north** to central Western Oregon (Newport and Albany). **East** to western Oregon (Albany); central California (Marysville, Stockton, Mariposa County, Redlands, and Potholes); southern Arizona (Tucson and Tombstone); and southwestern Sonora (Guaymas). **South** to southern Sonora. **West** to western Sonora (Guaymas and the Colorado River delta); western California (San Clementi Island, Santa Barbara, San Francisco Bay region, and Eureka); and western Oregon (Coss Bay and Newport).

The species as outlined is divided into two subspecies or geographic races. The Alaska myrtle warbler (*D. c. hooveri*) breeds from western Alaska and northwestern Mackenzie to central Alberta and central British Columbia; the eastern myrtle warbler (*D. c. coronata*) from western Saskatchewan eastward.

Migration.—Late dates of spring departure from the winter home are: Costa Rica—Guayabo, March 18. El Salvador—Volcán de San

Miguel, March 22. Guatemala—Nebaj, April 27. Honduras—Lancetilla, March 17. Mexico—Valles, San Luis Potosí, May 2. Puerto Rico—Mayagüez, April 8. Haiti—Port-au-Prince, April 27. Cuba—Habana, April 28. Bahamas—New Providence, April 2. Florida—Pensacola—May 13. Alabama—Birmingham, May 8. Georgia—Atlanta, May 20. South Carolina—Greenwood, May 12. Louisiana—Mansfield, May 2. Mississippi—Oxford, May 8. Tennessee—Nashville, May 17. Arkansas—Helena, May 18. Texas—Bonham, May 6. Oklahoma—Norman, May 3.

Early dates of spring arrival are: New York—New York, April 1. Massachusetts—Lynn, April 11. Vermont—St. Johnsbury, April 12. Maine—Portland, April 6. New Brunswick—Scotch Lake, April 11. Nova Scotia—Yarmouth, April 11. Quebec—Hatley, April 22. Newfoundland—St. Anthony, April 25. Labrador—Cartwright, May 24. Illinois—Chicago, March 24. Indiana—Bloomington, March 26. Ohio—Youngstown, April 1. Ontario—Harrow, April 3. Michigan—Sault Ste. Marie, April 9. Missouri—Columbia, March 27. Iowa—Sigourney, April 3. Wisconsin—New London, April 1. Minnesota—Minneapolis, April 4. Kansas—Independence, April 7. Nebraska—Red Cloud, April 1. South Dakota—Brookings, April 7. North Dakota—Fargo, April 13. Manitoba—Aweme, April 12. Saskatchewan—Eastend, April 22. Mackenzie—Simpson, May 7. New Mexico—San Antonio, April 18. Colorado—Colorado Springs, April 17. Wyoming—Laramie, April 15. Montana—Kirby, April 29. Alberta—Glenevis, April 14. Washington—Seattle, March 14. British Columbia—Courtenay, March 31; Atlin, April 21. Yukon—Sheldon Lake, April 26. Alaska—Wrangell, April 29; Fairbanks, May 7.

Late dates of spring departure of transients are: District of Columbia—Washington, June 1. Pennsylvania—Warren, June 6. Illinois—Chicago, June 3. Indiana—Waterloo, June 3. Ohio—Oberlin, May 31. Missouri—Concordia, May 25. Iowa—Grinnell, June 1. Nebraska—Nenzel, May 27. North Dakota—Argusville, May 30. California—Red Bluff, May 3. Nevada—Quinn River Crossing, May 21. Washington—Tacoma, May 3.

Late dates of fall departure are: British Columbia—Atlin, September 19; Courtenay, October 14. Mackenzie—Nahami River, October 25. Wyoming—Laramie, November 25. Saskatchewan—Yorkton, October 14. Manitoba—Brandon, October 31. North Dakota—Argusville, November 15. South Dakota—Faulkton, November 15. Kansas—Lawrence, November 12. Minnesota—St. Paul, November 5. Wisconsin—Racine, November 16. Iowa—Wall Lake, November 15. Missouri—Kansas City, November 16. Illinois—Murphysboro, November 21. Michigan—Detroit, November 19. Indiana—Indianapolis, November 20. Ontario—Point Pelee, November 23. Ohio—

Toledo, November 17. Newfoundland—Tompkins, October 4. Prince Edward Island—North River, October 15. Quebec—Kamouraska, November 9. New Brunswick—Saint John, November 4. Maine—Portland, November 9. New Hampshire—Durham, November 4. Massachusetts—Boston, November 27. New York—Brooklyn, November 22. Pennsylvania—Doylestown, November 29.

Early dates of fall arrival are: Washington—Bellingham, September 28. Oregon—Thurston, October 5. California—Eureka, October 12. Wyoming—Yellowstone Park, August 25. North Dakota—Fargo, September 8. South Dakota—September 15. Nebraska—Fairbury, September 30. Kansas—Lawrence, September 26. Oklahoma—Oklahoma City, October 12. Texas—Somerset, October 10. Iowa—Grinnell, September 6. Missouri—St. Louis, September 17. Illinois—Chicago, August 31. Indiana—Hobart, September 2. Ohio—Austinburg, August 25. Kentucky—Bowling Green, September 14. Tennessee—Athens, October 3. Arkansas—Rogers, October 4. Louisiana—Monroe, September 26. Mississippi—Edwards, September 22. New York—Rhinebeck, August 31. Pennsylvania—Pittsburgh, September 8. District of Columbia—Washington, September 9. West Virginia—Bluefield, September 12. Virginia—Naruna, September 22. North Carolina—Mount Mitchell, September 30. South Carolina—Spartanburg, September 21. Georgia—Round Oak, October 10. Alabama—Anniston, October 8. Florida—New Smyrna, October 4. Bahamas—Cay Lobos, November 22. Cuba—Habana, November 17. Dominican Republic—San Juan, October 1. Puerto Rico—Mayagüez, December 14. Costa Rica—Carrillo, October 2.

Banding.—The myrtle warbler comes rather more readily than other warblers to banding traps, especially in winter, and so has yielded several records of migration and of longevity for return to the place of banding. A myrtle warbler banded at Elmhurst, Long Island, on October 19, 1936, was recovered on December 9, 1936, at Awensdaw, S. C. One banded on October 2, 1932, at Fargo, N. D., was found dead December 5, 1932, at Clarence, La. Another banded at Wilton, N. D., on September 25, 1939, was found in January 1940 at Leola, Ark. One banded on February 2, 1930, at Gastonia, N. C., was shot on December 25, 1930, at Kings Creek, Cherokee County, S. C.

A banding station at Thomasville, Ga., obtained several records indicative of the birds' tendency to return to the same wintering place. Three birds banded in March 1920, were retrapped in February and March of 1921. One banded February 24, 1921, was retrapped February 5, 12, and 13, 1924, and found dead, apparently of starvation, on the fifteenth. A myrtle warbler banded on February 28, 1917, was retrapped in March 1920 and several times between March 1 and 17,

1921. It was then at least 5 years old and had made four round trips to the breeding grounds.

Another myrtle warbler banded at Huntington, Long Island, on October 23, 1933, was killed February 1, 1940, at Dunbar, S. C.; it was then at least 6½ years old.

Casual records.—At least six specimens of the myrtle warbler have been collected in Greenland: Fiskenaes, May 21, 1841; Julianehaab, about 1847; Godhavn, July 31, 1878; Nanortalik, May 23, 1880; Agpamiut, in Sukkertoppen District, October 15, 1931; and Kangea, near Godthaab, October 28, 1937. A specimen was taken from the stomach of a white gyrfalcon October 7, 1929, killed near the Post on Southampton Island. Two specimens have been collected on the Arctic Coast of Alaska: one on June 3, 1898, at Point Tangent; and one June 4, 1930, near Point Barrow. A myrtle warbler was collected May 25, 1879, on the northeast coast of Siberia at latitude 67° N. At sea about 100 miles from Cape Hatteras, several myrtle warblers were noted on October 16 and 31, 1930.

Egg dates.—Maine: 16 records, May 26 to June 23; 10 records, June 11 to 20, indicating the height of the season.

New Brunswick: 10 records, June 5 to 28; 6 records, June 13 to 21.

Nova Scotia: 14 records, May 23 to June 21; 7 records, June 3 to 17 (Harris).

DENDROICA CORONATA HOOVERI McGregor

ALASKA MYRTLE WARBLER

HABITS

The Alaska myrtle warbler is another subspecies that was described many years ago but only recently admitted to the A. O. U. Check-List. Richard C. McGregor (1899) described this warbler, from specimens collected in California, as a western race and named it for his friend Theodore J. Hoover, who collected the type and placed his material at his disposal. He called it *Dendroica coronata hooveri*, Hoover's warbler. In his description of it he says that it is "in colors and markings like *Dendroica coronata*, but with wing and tail much longer." His table of measurements shows that the wings of California males average .15 inch longer than those of eastern birds, and the tails .14 inch longer, less than ⅙ inch! Among the wing measurements of eastern males the individual variation is as great as the difference in his averages, the shortest measuring 2.80 and the longest 2.95 inches! It appears to be a quite finely drawn subspecies.

Dr. Oberholser (1938) says of it: "The Myrtle Warblers breeding in Alaska are recognizable as a western race of this species. They differ from the eastern bird in larger size and more solidly black breast in the male. The upper parts in winter plumage and in the young are also less rufescent than in the eastern bird."

The breeding range of this race, so far as known, extends from northwestern Mackenzie to western Alaska, and southward to central British Columbia and central Alberta. It has been found in winter from California to southeastern Louisiana, in the southeastern United States, and in northern Baja California and in southern Veracruz, in Mexico. It may be commoner than is supposed, as it is recognizable only with specimens in hand.

Dr. Joseph Grinnell (1900) writes of its habits in northern Alaska:

> Hoover's Warblers were numerous summer residents of the timber tracts throughout the Kowak Valley from the delta eastward. In the latter part of August scattering companies were frequenting the spruce, birch and cottonwoods, among the foliage of which they were constantly searching, with oft-repeated 'chits,' just as are their habits in winter in California. The last observed, a straggling flock of six or eight, were seen in a patch of tall willows about sunset of August 30th. The following spring the arrival of Hoover's Warblers was on May 22nd. They were already in pairs and the males were in full song. At this season they were confined exclusively to the heavier spruce woods. In the Kowak delta, on the 23rd of June, a set of five considerably-incubated eggs was secured. The nest was in a small spruce in a tract of larger growth, and only four feet above the ground. It is a rather loose structure of fine dry grass-blades, lined with ptarmigan feathers.

In the Atlin region of northern British Columbia, according to Mr. Swarth (1926), it is a common species, breeding mostly in the lowlands:

> A nest with five fresh eggs (Mus. Vert. Zool. no. 1992) was taken by Brooks on June 15. It was in a slender spruce, one of a small thicket in a locality that is largely poplar grown, about forty feet from the ground and near the top of the tree. It rested on the twigs forming the terminal forks of a branch, about three feet from the trunk. The outer walls of the nest were built mostly of the shredded bark of the fire-weed stalks, with a little fire-weed 'cotton,' some coarse grass and small twigs, and several wing and tail feathers of a small bird. In the lining there was some horse hair, mountain sheep hair and a few soft feathers.
>
> Another nest, containing newly hatched young on June 28, was in a small jack pine in open woods on the shore of Lake Atlin.
>
> During the last week in August and the first week in September the southward exodus was at its height. Flocks of warblers, mostly this species, flitted rapidly through the poplar woods, and there was a constant stream of myrtle warblers making long flights overhead. The last one, a single bird, was seen September 19.

As the breeding ranges of Hoover's warbler and Audubon's warbler approach each other in British Columbia and may even overlap it would not be strange if hybrids between these two closely related species should occasionally turn up. Joseph Mailliard (1937) calls attention to a number of such hybrids between both forms of *coronata* and *auduboni.* And more recently, Fred M. Packard writes to me: "I have inspected skins in most of the major museums in America to detect these hybrids, and have been surprised at the number I have found. All but two were taken in the Rockies or farther west, so that presumably the subspecies concerned is *D. c. hooveri.*"

DENDROICA AUDUBONI AUDUBONI (Townsend)

PACIFIC AUDUBON'S WARBLER

PLATE 34

HABITS

The Pacific Audubon's warbler is a handsome western species closely related to our familiar myrtle warbler, which to a large extent it replaces, and is much like it in behavior and appearance; but it has one more touch of color in its brilliant yellow throat, five spots of yellow instead of four, and it has more white in the wings and tail. Although its breeding range does not extend nearly as far north as that of the myrtle warbler, it extends farther south, and to considerably higher altitudes, breeding largely in the Canadian Zone among the pines, firs, and spruces. Including the range of the Rocky Mountain form (*memorabilis*), which has not yet been admitted to the A. O. U. Check-List, the type race breeds from central British Columbia, central Alberta, and west-central Saskatchewan southward to southern California, northern Arizona, New Mexico, and western Texas. Throughout most of this range it is widely distributed in the lowlands only during the winter, retiring to the mountains for the breeding season.

In the mountains of New Mexico it has been found breeding at altitudes of form 7,500 feet to over 11,000 feet. In Colorado it breeds at similar elevations and perhaps up to nearly 12,000 feet. In southern California, Dr. Joseph Grinnell (1908) found it breeding in the San Bernardino Mountains from 9,000 feet "almost to timber limit, 10,500 feet elevation, at least. * * * This was one of the most abundant birds of the San Bernardino mountains, and was widely distributed from the lower edge of the Transition zone up through the Boreal." Grinnell and Storer (1924) write:

> The Audubon Warbler is the most widely distributed and the most abundant of all the species of wood warblers found in the Yosemite region. It occurs in numbers throughout the main forested districts of the mountains during the summer season, and it frequents the deciduous trees and brush of the foothill and valley country in the winter time.
>
> Altitudinally its summer range extends from the beginning of the Transition Zone yellow pines on the west slope, at 3300 to 3500 feet, up through the lodgepole pines and other conifers of the Canadian and Hudsonian zones to the upper limit of unstunted trees at 10,000 feet or a little higher. * * *

During the summer season the Audubon Warbler keeps mainly to coniferous trees, foraging from 10 to 50 feet or more above the ground. In the Transition Zone and part of the Canadian Zone it shares this habitat with the Hermit Warbler, but at the higher altitudes it is the only warbler present in the evergreen forest.

Farther north, in Mono County, Calif., James B. Dixon tells me that he found it nesting between 7,600 and 9,500 feet elevation. Referring to the Toyabe region in Nevada, Dr. Jean M. Linsdale (1938) found the Rocky Mountain form in a somewhat different environment: "In the mountains the area occupied by this warbler agreed fairly well with the area covered with trees. Individuals were seen most often in aspens, limber pines, birches, willows, and mountain mahoganies." Angus M. Woodbury (MS.) says of the breeding range of the Rocky Mountain form in Utah: "It summers in altitudes ranging from about 7,000 to 10,000 feet and nests in almost any of the components of the forests in those altitudes; pine, fir, spruce, aspen, or oak."

In Washington, Audubon's warbler is common and well distributed from near sea level in the vicinity of Seattle and Tacoma up to about 8,000 feet in the mountains. Near Tacoma, D. E. Brown showed us some typical lowland haunts of this warbler in the so-called "prairie region." On this smooth, flat land, a fine growth of firs and cedars was scattered about in the open; the two or three local species of firs were most abundant and were growing to perfection, being well branched down to the ground.

Spring.—There is a northward as well as an altitudinal migration in the spring. Samuel F. Rathbun says in his notes from Seattle: "Although the Audubon's is of frequent if not regular occurrence during the winter, a migration of the bird through the region is to be noted each spring and fall." Near Seattle the first birds are seen and their song is heard about March 10 to 15, and numbers are seen passing through up to the latter part of April. "By way of comparison, in the Lake Crescent section the first are seen about April 2, at the earliest, and after three weeks the last appear to have passed by, as the species performs its spring migration in a leisurely manner." A later wave of migrants passes through Seattle between April 10 and 25, probably birds that nest farther north.

Migration is evident in Utah, for Woodbury (MS.) says: "In addition to its summer residence, it is a common migrant through the state, and a sparse winter resident, mainly at low altitudes. It migrates through the streamside and cultivated trees of the valleys, including shade trees and orchards. The migrations cover a period of about 6 weeks each in spring and fall, usually from about mid-April to the end of May and from mid-September to the end of October, but in different years the waves may be a little earlier or later."

In California, there is a gradual exodus of Audubon's warblers from the lowlands to the mountains during April and May. Mrs. Amelia S. Allen tells me that "by the end of April they have disappeared from the San Francisco Bay region." And Swarth (1926b) says that in May, following the spring molt, "there is a gradual withdrawal of the birds to the higher mountains and to more northern latitudes."

Audubon's warbler occurs abundantly on the Huachuca Mountains, Ariz., but as a migrant only, during March, April, and May. Swarth (1904) writes:

> Though distributed over all parts of the mountains, they were at all times more abundant in the higher pine region, than elsewhere; and on April 24, 1903, I found them particularly numerous along the divide of the mountains, evidently migrating. They could hardly be said to be in flocks on this occasion, for along the ridge, which runs almost due north and south, there was for several miles a continuous stream of Audubon Warblers travelling rapidly from tree to tree, always moving in a northerly direction; sometimes a dozen or more in one pine, and sometimes only two or three, but never stopping long and all moving in the same direction. Almost all that were seen on this occasion were high plumaged males, hardly half a dozen females being observed for the day.

This was about two weeks before the local breeding race (*D. a. nigrifrons*) might be expected to arrive.

Dr. Merrill (1888), at Fort Klamath, Oreg., found Audubon's warblers "extremely abundant during the migrations. A few males were seen at Modoc Point on the 8th and 9th of April, and at the Fort on the 15th; by the 20th they were quite plentiful. A second 'wave' composed of both males and females, which latter had not previously been seen, arrived about the 4th of May, when they suddenly became more abundant than ever, bringing *D. aestiva morcomi* and *H. lutescens* with them."

Nesting.—The only two nests of Audubon's warbler that I have seen were shown to me in Washington, near the State University at Seattle. The University is located on high land at the north end of Lake Washington, where the steep banks, sloping down to the lake, are heavily wooded with a mixed growth of large and small firs of at least two species, as well as cedars, alder trees, and maples. In the more open part of the woods I was shown, on April 29, 1911, a nest of this warbler placed about 30 feet from the ground on two small branches and against the trunk of a tall Douglas fir beside a woodland path. The other nest I saw in the previously described "prairie region" near Tacoma on May 14, 1911; it was placed only 9 feet from the ground but 10 feet out from the trunk of a dense Douglas fir growing in the open, and was well concealed in the thick foliage.

These nests were evidently typical for the region, according to Rathbun. He mentions in his notes two other nests. One, found

May 2, 1909, on the east side of Lake Washington and along a road, was 30 feet from the ground in a small hemlock, near the extremity of one of the limbs and 7 feet out from the trunk. The other, found May 11, 1913, was in a small fir about 30 feet up and about 4 feet from the trunk on one of the lower limbs. "The nest is a very beautiful structure, constructed outwardly of very small twigs from the fir or hemlock, inside of which are placed smaller ones of the same character, with black rootlets, and lined with feathers, of which a quantity are used, and a few horsehairs. It is a compactly built affair." Dawson and Bowles (1909) say that the nests are placed from 40 to 50 feet up, and usually measure 4 inches in width outside by 2¾ in depth; and inside 2 by 1½ inches. They are made externally of such materials as fir twigs, weed tops, flower pedicels, rootlets, and catkins, and are heavily lined with feathers of various birds—including grouse, ptarmigan or domestic fowls—these feathers often curving upward and inward so as partially to conceal the eggs.

Dr. J. C. Merrill (1898) found a very different type of nesting near Fort Sherman, Idaho: "Here a majority of the nests I found were in deciduous trees and bushes, generally but a few feet from the ground. One was in a small rose bush growing at the edge of a cut bank overhanging a road where wagons daily passed close to it. * * * Occasionally one was seen in deep woods by the roadside near where hay had been brushed off a load on a passing wagon; this was utilized for the entire nest except lining, making a conspicuous yellow object in the dark green fir or pine in which it was placed."

P. M. Silloway (1901) found a nest of Audubon's warbler near Flathead Lake, Mont., that was 18 feet from the ground in a fork of a willow. "The fork containing the nest was in a main stem, upright, a number of feet below the leaf-bearing part of the tree, so that the nest was exposed quite fairly to view." H. D. Minot (1880) found one at Seven Lakes, Colo., in an odd situation: "The nest, composed of shreds and feathers, with a few twigs without and hairs within, was built in a dead, bare spruce, about twenty feet from the ground, compressed between the trunk and a piece of bark that was attached beneath and upheld above, where a bough ran through a knot-hole, so compressed that the hollow measures 2¼ x 1¾, and 1½ inches deep." Dr. Chapman (1907) describes a nest from Estes Park, Colo., as "loosely constructed of weed-stems and tops, and strips of bark, lined with fine weeds and horse-hair."

Mr. Woodbury (MS.) describes Utah nests as "compactly woven, cup-shaped structures, usually of fine grasses, plant fibers or shredded bark, lined with feathers or some substitute, and camouflaged with some fine stringy material holding bracts or other small particles in place." He reports nests in such conifers as spruce, balsam, and ponderosa pine, and in aspen and oak.

J. Stuart Rowley writes to me: "In California, I have found several nests of this species in the San Bernardino Mountains and in the Mono County area in the northern part of the State. The nests I have found have all been beautifully made structures, securely fastened to small, low hanging branches of lodgpole pine, and placed about 10 to 12 feet from the ground."

Dr. Grinnell (1908) records three nests, found in the San Bernardinos; one "was twenty feet above the ground in the thick foliage of a short drooping fir bough. It was compactly composed of weathered grasses, frayed-out plant fibres, and tail and wing feathers of juncos and other small birds. Internally it was thickly lined with mountain quail feathers, some of the chestnut-colored ones sticking above the rim conspicuously. This feather feature seems to be characteristic of Audubon warblers' nests, as it was noticeably present in all that we saw." Another nest was 25 feet from the ground in one of the lowest branches of a yellow pine. The third "was snugly tucked away in a small clump of mistletoe on an alder branch twelve feet above the ground."

J. K. Jensen (1923) says of New Mexico nests: "The nests are usually placed on a horizontal limb of a pine or spruce, but also among dead twigs on the trunks of cottonwoods, and even in a cavity of some tree. All nests found were lined with a few feathers of Bluebirds and Long-crested Jay."

Nests in tamarack, cedar, and birch have been reported by other collectors.

Eggs.—Audubon's warbler lays from 3 to 5 eggs, almost always 4. They are ovate, tending toward short ovate, and are slightly glossy. They are grayish or creamy white, spotted and blotched with "raw umber," "Brussels brown," "argus brown," and sometimes "auburn," with underlying spots of "pale brownish drab," "light brownish drab," or "light mouse gray." The markings are often confined to the large end, and frequently the drab undertones are in the majority, sometimes running together to form a cap, and this is relieved with a few superimposed spots or blotches of dark "argus brown," or scattered small scrawls so dark as to appear almost black. The eggs generally are sparsely but rather boldly marked. The measurements of 50 eggs average 17.6 by 13.5 millimeters; the eggs showing the four extremes measure **19.4** by 14.0, 19.1 by **14.5**, and **15.4** by **12.3** millimeters (Harris).

Young.—The period of incubation is probably between 12 and 13 days, as with the Myrtle warbler. Mrs. Wheelock (1904) writes:

> In the brood whose incubation was closely watched, I found that twelve days elapsed between the laying of the last egg and the advent of the young. The female did most of the brooding; the male was found on the nest only once, but was usually perched on a neighboring tree warbling his enthusiastic little song, "cheree-cheree-cheree-cheree." After the young were feathered enough to

> leave the nest, which occurred when they were two weeks old, the male forgot to sing and became a veritable family drudge with the brood ever at his heels clamoring for food. * * * The pair whose young had hatched so early were very friendly, feeding them without much fear while I sat within three or four feet of the nest and on a level with it. They usually came with nothing to be seen in their beaks, but the insect food they had gleaned and carried in their own throats was regurgitated into the throats of the young. When the latter were five days old the mother bird, for the first time, brought an insect large enough to be seen, and crammed it into the open bill of one of the nestlings, and from that time on most of the food brought was eaten by the young while fresh.

The general opinion seems to be that two broods are often, perhaps usually, raised in a season. The young birds are the first to leave their mountain resorts, probably driven out by their parents, and are the first to appear in the lowlands.

Plumages.—The plumages and molts of Audubon's warbler are similar in sequence to those of the myrtle warbler; in juvenal and first fall plumages the two species are almost indistinguishable, though there is always more white in the tail feathers of the western bird, in which the white spot usually reaches the fourth feather even in young birds. In any plumage the white areas in the tail of Audubon's warbler occupy two more feathers on each side of the tail than in the myrtle warbler.

The juvenal Audubon's warbler is brown above, streaked with black and white, and white below, streaked with black; the sexes are alike. This plumage is worn but a short time; Dr. Grinnell (1908) says that it "is of very short duration, not more than fifteen days, I should say"; and Swarth (1926) says that is "worn but a few weeks. Tail and wing have scarcely attained full length when the first winter plumage begins to appear, and by the time the birds are drifting back into the lowlands in September the last vestige of the juvenal plumage is gone." This postjuvenal molt involves all the contour plumage and the wing coverts, but not the rest of the wings or the tail.

In the first winter plumage there is but slight difference between the sexes, the female being somewhat duller than the male and often with little or no yellow on the throat. In both sexes the plumage is browner throughout, the yellow areas are paler and less pronounced, the black streaks are less prominent, and the white areas in the tail are more restricted than in fall adults. Swarth continues: "All winter long these drab-colored birds pervade the lowlands, conspicuous only through force of numbers. Then, the latter part of March, comes the prenuptial molt that brings such marked changes to the male. This molt is extensive, far more so than with most of our birds in the spring, since it includes all of the plumage except flight-feathers and tail-feathers. At the close of the spring molt, about the middle of April as a rule, the male emerges, gorgeous in black breast and yellow trimmings, and with a showy white patch on either wing. The female, with similarly extensive molt, has changed but little in appearance." He probably intended this as a description of the adult prenuptial molt, but that of the young bird is practically the same. However, the young bird in first nuptial plumage can always be recognized by the faded and worn primaries and tail feathers; otherwise, young and old are essentially alike. Adults have a complete postnuptial molt in August and a partial prenuptial molt, as outlined, in early spring. Mr. Swarth (1926) says: "In winter plumage, old and young, male and female, are all very similar, but there are minor differences by which the old male, at least, may be told from the others. The dark streaks on the sides of the breast are a little more pronounced, the yellow markings a little brighter, and the body color a little clearer gray, as compared with the browner young birds."

Hybrids, or intergrades, occur occasionally between the different races of *auduboni* and *coronata* where their ranges approach or overlap.

Food.—Professor Beal (1907) examined the stomachs of 383 Audubon's warblers taken in California from July to May, inclusive. The food consisted of 85 percent of animal matter (insects and spiders) and a little more than 15 percent of vegetable matter. The largest item was Hymenoptera, 26 percent, consisting mostly of ants, with some wasps, and a few parasitic species. Diptera accounted for 16 percent, including house flies, crane-flies, and gnats, many of which must have been caught on the wing, as this warbler is a good flycatcher. Bugs, Hemiptera, amounted to nearly 20 percent of the food, including the black olive scale, other scales, plant-lice, stink bugs, leaf-hoppers and tree-hoppers. "Plant lice (Aphididae) were contained in 39 stomachs, and from the number eaten appear to be favorite food. Several stomachs were entirely filled with them, and the stomachs in which they were found contained an average of 71 percent in each." Caterpillars amounted to nearly 14 percent and beetles more than 6 percent of the food; most of the beetles were injurious species. Other insects and spiders made up about 2 percent.

The vegetable food consisted of fruits, mostly wild and of no value, less than 5 percent, and seeds, over 9 percent, mostly weed seeds and seeds of the poison oak. These warblers have been known to puncture grapes and they probably eat some late fruit, but they do very little damage to cultivated fruits and berries. C. S. Sharp (1903) observed a flock of 200 birds, mostly Audubon's warblers, greedily eating the raisins in the tray shed of his packing house; they had to be constantly driven away. Mrs. Amelia S. Allen says in her notes that they collect in great flocks in the live oaks to feed on the oak worms in the spring, and that they eat myrica berries in the fall. John G. Tyler (1913) says: "Audubon warblers share with Say Phoebes the habit of catching flies from a window, sometimes becoming so engrossed in this occupation as to cling for several seconds to the screen where a south-facing window offers a bountiful supply of this kind of food."

Behavior.—Audubon's warbler is a lively and active bird that seems to be always in a hurry, constantly moving in pursuit of its prey. Mrs. Bailey (1902) writes:

> Its flight and all its movements seem to be regulated by gnats, its days one continuous hunt for dinner. When insects are scarce it will fly hesitatingly through the air looking this way and that, its yellow rump spot always in evidence, but when it comes to an invisible gauzy-winged throng it zigzags through, snapping them up as it goes; then, perhaps, closing its wings it tumbles down to a bush, catches itself, and races pellmell after another insect that has caught its eye. In the parks it is especially fond of the palm tops frequented by the golden-crowned sparrows, and dashes around them in its mad helter-skelter fashion. The most straight-laced, conventional thing it ever does is to make flycatcher sallies from a post of observation when it has caught its insect. If it actually sits still a moment with wings hanging at its sides, its head is turning alertly, its bright eyes keen for action, and while you look it dashes away with a nervous *quip* into midair, in hot pursuit of its prey.

It is not especially timid, being easy to approach when at its nest, and it shows its confidence in human nature by building its nest in trees in parks, over highways, in gardens, and even close to houses. Its behavior in the defense of its young shows a solicitude for their welfare. Jensen (1923) says: "If a nest with young is discovered, both parent birds try every means possible to draw the attention of the intruder away from the nest. Often I have seen them drop with folded wings from the top of a tree and flutter among the leaves as if each had a broken wing." And Grinnell, Dixon, and Linsdale (1930) write:

> June 15, 1925, a female Audubon warbler was seen which showed concern whenever the observer went near a certain thicket of very small pines and willows. The bird came to within three meters of the intruder and distracted his attention by going through an elaborate display. The bird spread its tail fan-wise, showing the white spots to greatest effect, and quivered the partly spread wings, toppling over backwards at the same time, as if unable to hold to the perch. For an instant the observer thought the bird's foot was caught in the forking twigs. The inference finally made was that partly fledged young were in the low vegetation somewhere very near.

Voice.—Samuel F. Rathbun sends me the following note on the song of Audubon's warbler: "The first note or two is given rather slowly, then its utterance is more rapid and with a somewhat rising inflection, the song closing a little hurriedly. It is quite a strong and sprightly song, but its charm lies mostly in the fact that it is one of the first, if not the very first, of the warbler songs heard in the spring. The call note given by both sexes is the same, a quick and slightly lisping one that is also used in the autumn and at times in flight."

Dr. Walter P. Taylor (MS.) says of a song heard at Fort Valley, Ariz., on June 12, 1925: "The song seems much less full and seems lacking in quality, as compared with that of the Audubon in Washington State. It was so lacking in strength and quality that I took it for a Grace warbler." He wrote it as *wheetlea*, *wheetlea*, repeated 7 or 8 times, or *wheetoo*, 7 times repeated, or again *wheetleoo wheet*, the final syllable a little different from the others.

Mrs. Bailey (1902) says: "His song is of a strong warbler type, opening toward the end, *chwee*, *chwee-chwee-ah*, *chwee*, between the song of the yellow warbler and that of the junco." At Lake Burford, N. Mex., in May and June, according to Dr. Wetmore (1920), "males were found singing from the tops of the tallest pines and were slow and leisurely in their movements in great contrast to their habit at other seasons. Frequently while singing they remained on one perch for some time so that often it was difficult to find them. The song resembled the syllables *tsil tsil tsil tsi tsi tsi tsi*. In a way it was similar to that of the Myrtle Warbler but was louder and more decided in its character."

Dr. Merrill (1888) says: "On two or three occasions I have heard a very sweet and peculiar song by the female, and only after shooting them in the act of singing could I convince myself of their identity."

Field marks.—The male in his gay spring plumage is not likely to be confused with any other warbler except the myrtle warbler, from which it differs in having a brilliant yellow throat instead of a white one; in other words, *auduboni* has five patches of yellow against four for *coronata*. In immature and fall plumages the two species are much alike, but *auduboni* has four or five large white patches on each side of the tail, while *coronata* has only two or three, in the different plumages; these white markings are diagnostic in any plumage. The yellow rump is always conspicuous at any season, even when the other yellow markings are more obscured.

Fall.—The fall migration is a reversal of the spring migration, from the north southward and from the mountains down to the valleys and lowlands. Rathbun tells me that the southward migrants pass through Washington during October and November, but that a few remain there and even farther north, in winter. In California, Audubon's warblers that have bred in the mountains begin to drift downward to lower levels in August, the young birds coming first, so that by September they are well spread out over the lowlands almost down to sea-level. Soon after the first of October, the first of the migrants cross the border into Mexico on their way to winter quarters. Dr. Taylor tells me that in New Mexico during October these warblers are abundant in the aspens, being "by far the most numerous species of bird."

Winter.—Audubon's warbler is a hardy bird. At least some individuals remain in winter almost up to the northern limit of its breeding range; and while it retires entirely from its summer haunts in the mountains, most of its breeding range elsewhere is not wholly deserted. It probably remains as far north as it can make a living; its adaptability in finding a food supply helps in this and makes it one of the most successful of western birds as well as one of the most abundant in all parts of its range. A few remain, perhaps regularly, in coastal British Columbia, for Theed Pearse has given me five December dates and four February dates, spread out over a period of 10 years, on which he has recorded one or more Audubon's warblers on Vancouver Island; on one of these dates, February 10, 1943, the temperature dropped to −6° F.

Rathbun tells me it is "of frequent, if not regular, occurrence during the winter" in Washington. And in Oregon Gabrielson and Jewett (1940) record it as a "permanent resident that has been noted in every county during summer and throughout western Oregon in winter. * * * Its little song is heard on every side during May and June, and its peculiarly distinct call or alarm note is a familiar sound throughout the balance of the year. This is true not only of the wooded slopes and bottoms but equally so of the weedy fence rows of the Willamette Valley, where during the short days of fall and winter these warblers may be found associating with the Golden-crowned Sparrows and Willow Goldfinches or sitting on the telephone wires with the Western Bluebirds." Swarth (1926) writes:

> In much of the West, especially in the Southwest, the Audubon's warbler is one of the dominant species during the winter months. In southern California it vies with the Intermediate Sparrow and House Finch in point of numbers. Wherever there are birds at all, this bird is sure to be there. From the seacoast to the mountains, in city parks and gardens, in orchards and in chaparral, the Audubon's warbler is equally at home. On any country walk scores are sure to be seen, starting up from the ground or out of the trees with wavering and erratic flight, showing in departure a flash of white-marked tail-feathers and a gleaming yellow rump spot, and uttering the incessant *chip* that, better than any marking, serves to identify the fleeting bird.

In colder sections there are some fatalities; in the Fresno district, according to Tyler (1913), "a period of two or three unusually cold nights frequently results disastrously for these little warblers, and my observations show that there is a greater mortality among this species than in all other birds combined. After a hard freeze it is not an uncommon occurrence to see certain individuals that appear so benumbed as to be almost unable to fly, and not a few dead birds have been been found under trees along the streets."

From much farther south, in Central America, Dr. Alexander F. Skutch (MS.) writes:

"Audubon's warbler is a moderately abundant winter resident in the higher mountains of Guatemala, yet like the closely related myrtle warbler, appears to be less regular in its time of arrival and departure and less uniformly distributed, than the majority of the more common winter visitants. These attractive warblers were abundant on the Sierra de Tecpán from January until April, 1933; but strangely enough they did not return in August or September with all the other warblers that winter there; and none had appeared by the end of the year, although I kept close watch for them. Yet in the middle of the following September, I found them numerous among the pine and alder trees on the Sierra Cuchumatanes, nearly 11,000 feet above sea-level. The males were then resplendent in their full nuptial dress of yellow, black, white and gray, and sang enchantingly. I believe it not impossible that they breed in this remote, little-known region—for here also I found a breeding representative of the savannah sparrow, hitherto known only as a migrant in the country—and it is to be hoped that some day an ornithologist will study the bird-life of this lofty plateau during the breeding season, from April to August.

"During the winter months, the Audubon warblers are truly social, and are nearly always met in flocks, sometimes containing 25 or more individuals. They are versatile in their modes of finding food. Sometimes, from the tops of the tall cypress trees near the summit of the Sierra de Tecpán, they would launch themselves on long and skillfully executed sallies to snatch up insects on the wing. As they twisted about in the air, they would spread their tails to reveal the prettily contrasting areas of black and white. At other times they foraged on the ground, like the myrtle warblers; and this habit brought them into contact with the bluebirds (*Sialia sialis guatemalae*), which are likewise arboreal birds that frequently descend to hunt on the ground. At altitudes of 8,000 to 9,000 feet I almost always found the Audubon warblers and the bluebirds together in the bare, close-cropped pastures where there were scattered, low, oak trees; and this association was so constant that it could not have been accidental. Both kinds of birds were exceedingly wary as they hunted over the ground, and would fly up into the trees if they espied a man approaching them, even from a long way off. The Audubon warblers, probably because they more frequently enter open, exposed places, where they are conspicuous and far from shelter and must exercise great caution not to be surprised, were by far the shiest and most difficult to approach of all the warblers of the Sierra, whether resident or migratory. This was true whether they happened to be in the trees or on the ground.

"In the evening, foraging over the ground as they went, the Audubon warblers and bluebirds would go together to bathe in one of the rivulets that flowed through the pastures. After splashing vigorously in the shallow water they would fly up together into the raijón bushes, shake the drops from their feathers, sometimes wipe their wet faces against the branches, and put their plumage in order again. The last Audubon warbler that I saw in the spring was a lone female, who foraged in company with a pair of the resident bluebirds in the open pasture. She must have appreciated the companionship of the bluebirds more than ever, after all of her own kind had departed for more northerly regions.

"Guatemalan dates are: Sierra de Tecpán, January 16 to April 23, 1933; Sierra Cuchumatanes, September 13, 1934; Chichicastenango (Griscom), November 16."

DISTRIBUTION

Range.—Western North America from central British Columbia to Guatemala.

Breeding range.—Audubon's warbler breeds **north** to central British Columbia (Hazelton, Fort St. James, and Nukko Lake) and central western Alberta (Smoky River). **East** to southwestern Alberta (Smoky River, Jasper Park, Banff National Park, and Crowsnest Lake); casually to southwestern Saskatchewan (Cypress Hills); western Montana (Fortine, Teton County, Bozeman, and Fort Custer); western South Dakota (Harding County and the Black Hills); northwestern Nebraska (Warbonnet Canyon, Sioux County); central Colorado (Estes Park, Gold Hill, Colorado Springs, Wet Mountains, and Fort Garland); central New Mexico (Taos, Ruidoso, and Cloudcroft); western Texas (Guadalupe Mountains); and western Chihuahua (Pinos Altos); in migration much farther east. **South** to central western Chihuahua (Pinos Altos); southeastern to northcentral Arizona (Huachuca Mountains, Santa Catalina Mountains, Flagstaff, and Grand Canyon); southwestern Utah (Zion National Park); southern Nevada (Charleston Mountains); central southern California (San Bernardino Mountains and the Santa Rosa Mountains); and northern Baja California (Sierra San Pedro Mártir). **West** to northern Baja California (Sierra San Pedro Mártir); southwestern California (San Jacinto Mountains and Mount Wilson); central eastern California (Yosemite Valley and Big Trees); western California (Diablo, Mount Tamalpais, Fort Ross, and Trinity Mountains); western Oregon (Coos Bay, Eugene, Corvallis, and Netarts); western Washington (Cape Disappointment, Shelton, and the San Juan Islands); and western British Columbia (Cowichan Lake and Port Hardy, Vancouver Island; and Hazelton).

Winter range.—The Audubon warbler is found in winter **north** to southwestern British Columbia (Comox and Chilliwack). **East** to southwestern British Columbia (Chilliwack); central Washington (Yakima); occasionally eastern Washington (Cheney); northeastern Oregon, casually (Pendleton and Legrande); central California (Marysville and Fresno); casually to southwestern Utah (St. George and Zion National Park); central Arizona (Fort Mojave, Fort Verde, Salt River National Wildlife Refuge, and Tombstone); southern Texas (El Paso, rarely Knickerbocker, and Brownsville); Tamaulipas (Matamoros and Victoria); western Veracruz (Orizaba); and central Guatemala (San Jerónimo). **South** to Guatemala (San Jerónimo, Tecpán, and San Lucas); casual or accidental south to central Costa Rica (Juan Viñas). **West** to western Guatemala (San Lucas and Totonicapán); Oaxaca (Parada); Guerrero (Chilpancingo and Coyuca); western Jalisco (Tonila); Nayarit (Tepic); southern Sinaloa (Mazatlán); western Baja California (Santa Margarita and Natividad Islands); and the west coast of the United States to southwestern British Columbia (Comox).

The preceding range is for the species as a whole of which two subspecies or geographic races are recognized. The Pacific Audubon's warbler (*D. a. auduboni*) breeds south to southern California, central Arizona, and New Mexico; the black-fronted Audubon's warbler (*D. a. nigrifrons*) breeds from the Huachuca Moutains, Ariz., through the mountains to southwestern Chihuahua.

Migration.—Late dates of spring departure from the winter range are: Guatemala—Tecpán, April 23. Sonora—Moctezuma, May 23. Texas—Marathon, May 18. Kansas—Fort Wallace, May 27. Arizona—Prescott, May 19. California—Fresno, May 3.

Early dates of spring arrival are: Kansas—Garden City, April 22. Nebraska—Hastings, April 14. New Mexico—Apache, March 7. Colorado—Colorado Springs, April 12. Wyoming—Laramie, April 21. Montana—Fortine, April 14. Alberta—Banff, April 23. Utah—St. George, March 8. Nevada—Carson City, April 10. Idaho—Sandpoint, April 16. California—Grass Valley, April 10. Oregon—Prospect, March 6. Washington—Shelton, March 4. British Columbia—Summerland, March 30.

Late dates of fall departure are: British Columbia—Okanagan Landing, October 24. Washington—Pullman, November 13. Oregon—Prospect, November 18. Idaho—Bayview, October 26. Utah—St. George, December 7. Alberta—Edmonton, September 11. Montana—Fortine, October 24. Wyoming—Laramie, November 9. Colorado—Fort Morgan, October 30. New Mexico—Silver City, November 10.

Early dates of fall arrival are: California—San Diego, September 2. Texas—Fort Davis, September 9. Sonora—Las Cuevas, September 3. Guatemala—Chichicastenango, November 16.

Banding.—An Audubon's warbler that was banded at Santa Cruz, Calif., on February 17, 1931, was found dead November 5, 1931, at Glenwood, Calif. Another, banded at Altadena, Calif., on December 1, 1935, was retrapped at the same station on February 13, 1940, being then nearly 5 years old, at the least.

Casual records.—A specimen of Audubon's warbler was collected at Cambridge, Mass., on November 15, 1876. Another was collected at West Chester, Pa., November 8, 1889. In Ohio one was closely watched at Cleveland April 30 and May 3, 1931; and a second one at Richmond on October 5, 1941. On April 28, 1928, one was closely watched at Minneapolis, Minn.

Egg dates.—California: 53 records, May 11 to July 30; 28 records, June 13 to 25, indicating the height of the season.

Colorado: 10 records, June 18 to July 6; 5 records, June 19 to 29.

Washington: 11 records, April 19 to June 29; 5 records, May 14 to June 13.

DENDROICA AUDUBONI NIGRIFRONS (Brewster)

BLACK-FRONTED AUDUBON'S WARBLER

HABITS

The black-fronted Audubon's warbler was originally described by William Brewster (1889) as a distinct species, based on a series of five specimens collected by M. A. Frazar in the Sierra Madre Mountains of Chihuahua, Mexico, in June and July, 1888. He gave as its characters: "Male similar to *D. auduboni* but with the forehead and sides of the crown and head nearly uniform black, the interscapulars so closely spotted that the black of their centres exceeds in extent the bluish ashy on their edges and tips, the black of the breast patch wholly unmixed with lighter color. Female with the general coloring, especially on the head, darker than in female *auduboni;* the dark markings of the breast and back coarser and more numerous; the entire pileum, including the yellow crown patch, spotted finely but thickly with slaty black." He admits that it is closely related to *D. auduboni*, "so closely in fact that the two may prove to intergrade," but he found no indications of such intergradation. Later, however, Leverett M. Loomis (1901) called attention to the fact that several birds, collected in the Huachuca and Chiricahua Mountains, in Arizona, showed signs of intergradation with breeding birds from central California. These were taken by W. W. Price, establishing this bird as an addition to our fauna, and resulting in its reduction to subspecific rank. It is known to breed in the Huachuca Mountains and in the high Sierras of northwestern Mexico, ranging south to Guatemala. Swarth (1904) says of the status of the black-fronted warbler in Arizona:

> This, the only form of *auduboni* that breeds in the Huachucas, occurs during the summer months, though in rather limited numbers, in the higher pine regions from 8500 feet upwards. On one occasion, April 5, 1903, I secured a male *nigrifrons* from a flock of *auduboni* feeding in some live-oaks near the mouth of one of the canyons at an altitude of about 4500 feet, but this is the only time that I have seen it below the altitude given above; and it is also exceptional in the early date of its arrival. No more were seen until the second week in May, which seems nearer the usual time of arrival, for in 1902, the first was seen on May 9th. * * * Several specimens were taken intermediate in their characteristics between *auduboni* and *nigrifrons;* some, of the size of the latter, though in color but little darker than *auduboni,* while some show every gradation of color between the two extremes.

The black-fronted warbler averages somewhat larger than the Audubon's.

Nesting.—Before this warbler was known to be the breeding form in Arizona, O. W. Howard (1899) reported on two nests found in the Huachuca Mountains in 1898, and said that he had found "several nests" of Audubon's warblers in 1897 and 1898, all in these mountains. These were all, doubtless, nests of the black-fronted warbler. One of these was in a red fir tree about 15 feet up, and the other "was placed in the lower branches of a sugar-pine about fifty feet from the ground, and twelve feet out from the trunk of the tree. * * * The nests are very loosely constructed, being composed almost entirely of loose straws with a few feathers and hair for a lining." One of Howard's nests of this warbler, with four eggs, is in the Thayer collection in Cambridge. It was found in the same mountains, at an elevation of about 9,000 feet, saddled on the limb of a red spruce tree 35 feet above ground and well concealed in the foliage. It is rather a bulky nest made of shredded weed stems, fine strips of inner bark, fine rootlets and various other plant fibers, mixed with feathers of the Arizona jay, three long wing feathers of small birds and two small owl feathers; it is lined with fine fibers, horse and cattle hair, and jay feathers. Externally it measures about 3½ inches in diameter and 2½ in height; the inside diameter is about 2 inches and the cup is about 1¾ inches deep.

James Rooney has sent me the data for a set of four eggs of the black-fronted warbler, taken by Clyde L. Field in the Santa Catalina Mountains in Arizona, June 2, 1938. The nest, placed 15 feet above ground at the end of a pine limb, was made of twigs and was lined with deer hair and a few feathers. A nest with four eggs, in the collection of Charles E. Doe, in Florida, was taken by the same collector in the same mountains on June 8, 1937; it was in a crotch of an aspen, 30 feet up.

Eggs.—The measurements of 16 eggs average 18.5 by 13.6 millimeters; the eggs showing the four extremes measure 19.8 by 14.0, 19.5 by 14.4, 17.3 by 13.9, and 17.6 by 12.4 millimeters (Harris).

DENDROICA NIGRESCENS (Townsend)

BLACK-THROATED GRAY WARBLER

Plate 35

HABITS

The black-throated gray warbler is neatly dressed in gray-black and white, with only a tiny spot of bright yellow in front of the eye. Its breeding range extends from southern British Columbia, Nevada, northern Utah, and northwestern Colorado southward to northern Lower California, southern Arizona, and southern New Mexico. It spends the winter in Mexico.

As a summer resident it is common and sometimes abundant in western Washington, even at lower elevations where, Samuel F. Rathbun tells me, it "prefers a locality somewhat open, with a second growth of young conifers; this may occur in the rather heavy forest, if such condition exists there, or along the edge of the timber; the species is partial to this character of growth."

In southern Oregon, according to C. W. Bowles (1902), it seems to combine the habitat requirements of the eastern black-throated green and the prairie warbler. Like the former, it seeks tall trees, preferably conifers, well scattered and interspersed with bushes, since it nests in both. Like the prairie warbler, it chooses high dry places with dry ground underneath for its nest.

Farther south, the black-throated gray warbler seems to prefer growths of hardwood and underbrush for its summer haunts—oaks, scrub oak, pinyon, juniper, manzanita, and the like. Dr. Walter K. Fisher wrote to Dr. Chapman (1907) that, in California, "it lives in chaparral such as deer brush, wild lilac of various species, scrub oak, and sometimes, particularly in the humid coast districts, among evergreens. It is fond of the neighborhood of clearings where it works constantly and carefully among low growth." Dr. Grinnell (1908) says that in the San Bernardino Mountains, "this warbler appeared to be be confined exclusively to the golden oak belt during the breeding season." Referring to the Great Basin region, Dr. Linsdale (1938) writes: "The black-throated gray warbler was one of the few species adapted to occupy the piñon belt on the Toyabe Mountains. Not only did this bird tolerate conditions on dry slopes, but it was practically limited to them. The pairs were scattered far apart, but because this type of habitat takes up so much of the total area, this warbler must rank high among all the summer resident birds on the basis of numbers."

This warbler is a common breeding bird in the mountains of southern Arizona. In the brushy foothills and canyons of the Huachucas, we found it between 4,000 and 7,000 feet in altitude, in the oak belt about halfway up the canyons, principally among the scrub oaks and manzanita bushes. In New Mexico, according to Mrs. Bailey (1928), it is found in summer at slightly higher levels, 5,500 to 8,000 feet, in the oak and pinyon pine country.

Nesting.—In Washington, the black-throated gray warbler seems to nest in fir trees exclusively, at heights ranging from 7 or 8 feet up to 50 feet above the ground. Rathbun has sent me the data for seven nests, all in firs, at heights ranging from 7½ to 35 feet; they were all on horizontal branches and from 4 to 10 feet out from the trunk. He describes in his notes a typical nesting site as follows: "From a distance I saw a fir tree the character of which, from my experience, was favored by this warbler as a nesting place. It was of considerable size, one of a number scattered along the edge of the forest, and had considerable undergrowth beneath. After a very careful examination I located the nest near the extremity of one of the large lower limbs, at a distance from the trunk of 9 feet and at a height above the ground of 23 feet. The nest was placed at the side of the limb and was securely attached at a point where grew several small twig-like branches." He says that this bird is very regular in its nesting date, the average date for fresh eggs is between June 3 and 8, and that the nest is always a neat one. He describes a typical nest as follows: "Plant fibers, dry grasses and a few very small weed-stalks were all neatly woven together to form the walls of the nest. The lining was a few feathers—two being those of the ruffed grouse, with others from sparrows, the quill of each being worked into the walls of the nest; next to this lining were soft and very fine plant fibers, with a few horsehairs."

C. W. Bowles (1902) mentions a nest in southern Oregon that "was six feet up in a manzanita bush in a patch of bushes of the same variety about three acres in extent." But he adds that—

> the nests were from three feet and three inches to twenty-five feet from the ground, oaks seeming the favorite in southern Oregon and fir near Tacoma. The usual situation is in a small clump of leaves that is just large enough to almost completely conceal the nest, and yet so very small that a crow or jay would never think of anything being concealed in them. * * * The nests externally are about 3 x 2¾ inches and internaly 1¾ x 1¾ inches in diameter and depth. They are composed externally of grass and weed-stalks, that must be several seasons

old, (being bleached and very soft) moss and feathers; and lined with feathers (one had evidently been lined from a dead Stellar jay), horse, cow and rabbit hair or fur, and sometimes the very fine stems of the flowers of some kind of moss. The male has never been seen to assist either at nest-building or incubation.

In the Yosemite region, where Grinnell and Storer (1924) found the black-throated gray warbler in fair numbers among the golden oaks on the north walls of the Valley, they found a nest "placed 5 feet 6 inches above ground in a mountain lilac (*Ceanothus integerrimus*) bush against a main stem."

From southern California, James B. Dixon writes to me: "This bird breeds sparingly from 2,500 feet to the tops of our mountain ranges in San Diego, Riverside and San Bernardino Counties. During my observations since 1898, I have seen but five nests. One was in a live oak tree, two in manzanita bushes and two in golden oak saplings." A nest in Riverside County, at 5,500 feet elevation, was in "a scrub growth area which was well wooded with sapling golden oak and manzanita, buck thorn, and other sparsely growing bushes." The nest was "located 12 feet from the ground in a deep, vertical crotch of a golden oak sapling, and could be seen from only one angle, much like the nest of a gnatcatcher or wood pewee." Another nest was found "in the dense growth of a young manzanita bush. * * * The locations of the two nests were extremely different, one was carefully concealed in a comparatively bare oak sapling, and the other in the dense foliage of a rank-growing young manzanita bush."

In the Huachuca Mountains of Arizona, I found but one nest of the blackthroated gray warbler. It was 5 feet up in the main crotch of a small oak growing on a steep slope on the side of a branch of Ramsey Canyon; the slope was sparsely covered with scrub oaks and other bushes, with a scattering of tall pines; the nest was so well concealed that I could not get a clear photograph of it. Howard (1899) found three nests in these mountains in upright forks of oak saplings, and says: "I found other nests, some placed in large white oaks and some in sycamores and have known the birds to build high up in pines." One of his nests from these mountains, in the Thayer collection, was found only 18 inches up in a young fir tree in a thicket; lying against the main stem, it was supported, surrounded, and well concealed by live twigs. Four other nests in this collection, were all taken in the Huachuca and Chiricahua mountains from oaks at heights ranging from 6 to 16 feet above ground. All much alike, their decidedly gray appearance makes them less visible among the gray branches. They are made of light gray, old, shredded stems of dead weeds and grasses, very fine gray plant fibers and a few dead leaves, bits of string, and thread, all firmly bound with spider's web and decorated with numerous bits of spider cocoons. They are lined with fine brown and white hairs and small, soft feathers.

In New Mexico, Jensen (1923) reports two nests in piñon pines; one was 3 feet and the other 5 feet above ground.

Eggs.—From 3 to 5 eggs, usually 4, constitute a full set for the black-throated gray warbler. These are ovate to short ovate and are only slightly glossy. The ground color is white or creamy white and is speckled, spotted, and sometimes blotched with "chestnut," "auburn," "bay," or "russet," occasionally with "mummy brown," with underlying spots of "light brownish drab," or "light vinaceous drab." The spots are usually concentrated at the large end, forming a loose wreath, with the drab markings frequently in the majority. Some eggs are only lightly speckled, while others are boldly marked. The measurements of 50 eggs average 16.5 by 12.5 millimeters; the eggs showing the four extremes measure **18.2** by 12.3, 18.1 by **13.1**, **14.6** by 12.9, and 16.2 by **11.6** millimeters (Harris).

Young.—The period of incubation does not seem to have been recorded for this warbler. It is probably performed by the female entirely, but both parents share in the feeding of the young. Information on this subject is scanty.

Plumages.—The young black-throated gray warbler in juvenal plumage shows the characters of the species more than do the young of other wood warblers; the black and white areas about the head and throat are strongly indicated in a duller pattern and there are two broad white bars tipping the median and greater wing coverts (see pl. 35); these markings are more subdued in the female than in the male, thus making a slight sexual difference. The back is brownish gray and the underparts grayish white, faintly streaked with black.

I have not been able to trace the postjuvenal molt, but it is perhaps less extensive than in most other warblers. In first winter plumage the young male is much like the adult male at that season, but it is more strongly washed with brown above and with yellowish beneath, the chin is white, the black throat is mottled with white, and the streaking above and below is duller and more obscured. The young female differs from the adult female in about the same way.

Apparently, the nuptial plumage is produced mainly by wear, or by a limited prenuptial molt. The postnuptial molt is evidently complete in late summer.

The adult winter plumages of both sexes differ but little from the spring plumages; in the male, the feathers of the upper parts and cheeks are margined with brownish gray and the throat with white, the sides are washed with brown and the black streaks are obscured; in the female, the plumage is tinged with brownish in the same way and the black streaks are obscured.

Food.—No extensive study of the food of the black-throated gray warbler seems to have been made. It is evidently mainly, if not wholly, insectivorous, for several observers have mentioned its zeal in foraging among the foliage of trees and bushes for insects, with a special fondness shown for oak worms and other green caterpillars. Bowles (1902) says that "it seems to prefer oak trees in the spring because of the small green caterpillars that are very numerous on them and which are devoured on all occasions. One female must have eaten nearly half its weight of them (from three-fourths to one and one-half inches long) while its nest was being taken." Mrs. Wheelock (1904) writes in the same vein: "In the spring these oaks are particularly infested with the green caterpillars, and the Warblers never seem to tire of devouring the pests. They lean way over to peer under every leaf, or reach up to the twigs overhead, never missing one. Twenty of these worms is an average meal for a Black-throated Gray Warbler, and the total for a day must reach into the hundreds."

Behavior.—The black-throated gray warbler is not one of the most active wood warblers except when it is busy feeding; even then it goes about it in a quiet, businesslike manner, without much concern over the presence of humans. At other times, it is rather shy and retiring, difficult to follow, as it slips away silently in the thick underbrush, where it spends so much of its time. Its nest is difficult to find, for it is not only well concealed, but the bird is careful not to betray it; our usual method of following a bird to its nest was not very successful, as it was soon lost to sight while we were watching it.

Mr. Bowles (1902) writes of its behavior that an incubating female "passed the time eating caterpillars while the nest was being examined. She did not go over five feet from it this time, till I left when she followed for about twenty feet, and kept almost within reach, watching me very closely. * * * Black-throated gray warblers do not object to human association at all; one nest was fifteen feet up on an oak branch, directly over a trail that was used at least six times a day by people going for mail, and generally much oftener."

William L. Finley (1904a) describes quite different behavior at a nest containing young: "The moment the mother returned and found me at the nest she was scared almost out of her senses. She fell from the top of the tree in a fluttering fit. She caught quivering on the limb a foot from my hand. But unable to hold on, she slipped through the branches and clutched my shoe. I never saw such an exaggerated case of the chills. I stooped to see what ailed her. She wavered like an autumn leaf to the ground. I leaped down, but she had limped under a bush and suddenly got well. Of course I knew she was tricking me! But I never saw higher skill in a feathered artist."

Voice.—The simple, but pleasing song of the black-throated gray warbler is described in Rathbun's notes as follows: "The song as ordinarily sung consists of three rather quickly given notes, of a somewhat lisping quality, that rise and fall but are alike in construction and a closing fourth note that may slur upward with a decided accent, or may fall. The real construction of this song is lost unless the singer is close by, for then it will be found that each of the first three notes is a double one. It is a clear and pleasing song, of good carrying quality, and somewhat smooth when heard at a distance. During the nesting season the males will be heard in song much of the time during the day. The habit of the bird is to perch on or near the top of a young evergreen tree and sing repeatedly without shifting its perch, then to fly to another tree of similar character and repeat its actions."

As I heard it in Washington, I wrote it *swee*, *swee*, *ker-swee*, *sick*, or *swee*, *swee*, *swee*, *per-swee-ee*, *sic*. Dr. Walter P. Taylor writes it in his notes *zee zeegle*, *zeegle*, *zeegle*, *zort*, *tseeee*. Grinnell and Storer (1924) describe it as "a rather lazy, drawling utterance, deep-toned rather than shrill. *Wēē-zy*, *wēē-zy*, *wēē-zy*, *wēē-zy-weet; tsewcy*, *tsewey*, *tsewey*, *tsewey-tsew; zuēē*, *zuēē*, *zuēē*, *soop; sĭ-sĭ-wēēzy*, *wēēzy we-tsú; owēzē-wēzē-wēzē-wēzē-chŭr*, are syllabifications written by us at different times when individual birds were singing close at hand. There are modifications in the song; sometimes the terminal syllable is omitted and again only three of the two-syllabled notes are given. The ordinary call is a rather low, one-syllabled *chit*."

Mrs. Bailey (1902) says that "its song is a simple warbler lay, *zee-ee-zee-ee*, *ze*, *ze*, *ze*, with the quiet woodsy quality of *virens* and *caerulescens*, so soothing to the ear." Bowles (1902) heard an unusual song that "was on the principle of a yellow-throated vireo or a scarlet tanager; but the quality of a blue-headed vireo in addition, making a very strong and rich song."

Field marks.—The gray back, white breast with a few black streaks, two white wing bars, and, particularly, the conspicuous black and white pattern of the head and throat will make this warbler almost unmistakable. The tiny yellow spot in front of the eye is visible only at close quarters. Young birds and adults in the fall show the same characters more or less obscured by brownish edgings. The female has a white throat instead of a black one.

Enemies.—Jays of different species and crows evidently take heavy toll of the eggs and young, as they are persistent nest hunters and often have their own broods to feed near by. Bowles (1902) says that "one pair of California jays seemed to have located every nest that was built in a gulch where they were building their own nest." One of the Grinnell and Storer (1924) party "interrupted an attack by a California Striped Racer upon a brood of Black-throated Gray Warblers. The female parent was much excited, flying from twig to twig, calling, and fluttering her wings. Near by, on the ground, was one of the young warblers. There was good evidence that the snake had already swallowed another member of the brood." This warbler seems to have escaped any interference by cowbirds.

Fall.—The southward migration begins in September and is mainly accomplished during that month; Washington is generally vacated during September, but migration continues through California during the first half of October; after the middle of October even southern California is deserted, and the black-throated gray warblers have gone to their winter haunts in Mexico.

DISTRIBUTION

Range.—Western North America from central British Columbia to southern Mexico.

Breeding range.—The black-throated gray warbler breeds **north** to southwestern British Columia (Hagensborg and Lillooet). **East** to southwestern British Columbia (Lillooet and Chilliwack); western Washington (Bellingham and Leavenworth); central northern Oregon (The Dalles); possibly southwestern Idaho (Riddle); southwestern Wyoming, possibly (Mountain); western and southern Colorado (probably Escalante Hills, Coventry, and the Culebra Range); central New Mexico (Santa Fe); and northeastern Sonora (San Luis Mountains). **South** to northeastern Sonora (San Luis Mountains); southeastern to north-central Arizona (Huachuca Mountains, Santa Rita Mountains, Santa Catalina Mountains, and Bill Williams Mountain); and northeastern Baja California (Sierra San Pedro Mártir). **West** to northern Baja California (Sierra San Pedro Mártir); western California (San Jacinto Mountains, Glendora, Santa Lucia Peak, and Lakeport); western Oregon (Kirby, Coos Bay, Corvallis, and Portland); western Washington (Spirit Lake and Shelton); and southwestern British Columbia (Victoria, Stuart Island, and Hagensborg).

Winter range.—The principal winter home of the black-throated gray warbler is in western Mexico. It is found in winter **north** to extreme southern Arizona (Yuma, occasionally in the Baboquivari Mountains, and Tucson). **East** to southeastern Arizona (Tucson); eastern Sonora (Tesia and Alamos); southwestern Durango (Chacala); northern Michoacán (Patambán); Mexico (city of Mexico); and central Oaxaca (Oaxaca). **South** to central Oaxaca. **West** to western Oaxaca (La Parada); Guerrero (Chilpancingo); western Michoacán (Los Reyes); southern Sinaloa (Escuinapa and Mazatlán); southern Baja California (Victoria Mountains and San José del

Rancho); and southwestern Arizona (Yuma). It has also been found at this season casually, south to Duenas, Guatemala, and north to Pasadena and Eureka, Calif., and Cameron County, Tex.

Migration.—Early dates of spring arrival are: New Mexico—Cooney, April 6. Arizona—Santa Rita Mountains, March 21. California—Grass Valley, March 24. Oregon—Portland, April 14. Washington—Tacoma, April 10. British Columbia—Chilliwack, April 16.

Late dates of fall departure are: British Columbia—Courtenay, September 7. Washington—Yakima, October 27. Oregon—Eugene, October 11. California—Diablo, November 11. Arizona—Phoenix, November 8.

Casual records.—A black-throated gray warbler was picked up dead at Lenox, Mass., on December 8, 1923. A specimen was collected at Ithaca, N. Y., on November 15, 1936. On December 8, 1941, an individual was observed on Bull's Island, S. C.; and from December 26, 1942, to January 5, 1943, one was under observation at Miami, Fla.

Egg dates.—Arizona: 12 records, May 4 to June 19; 7 records, May 17 to 26.

California: 32 records, May 1 to July 3; 18 records, May 20 to June 10, indicating the height of the season.

Washington: 8 records, May 29 to June 28; 5 records, June 5 to 23 (Harris).

DENDROICA TOWNSENDI (Townsend)

TOWNSEND'S WARBLER

HABITS

This warbler always reminds me of our familiar black-throated green warbler, which it resembles slightly in color pattern but more particularly in its habits and its drowsy song. Its voice is as much associated with the northwestern forests of tall firs as is that of our eastern bird with the pine woods of New England. Its breeding range is confined to the coniferous forests from Prince William Sound and the upper Yukon in Alaska south to Washington and east to southwestern Alberta and western Montana, but it is better known as a migrant through the Rocky Mountain region in general and as a winter visitant in California.

Samuel F. Rathbun writes to me from Seattle, Wash., that Townsend's warbler is widely distributed throughout that region. "It is found in the lowlands to some extent as a summer resident, but by far the greater number of the birds will be found summering in the more mountainous and unsettled parts of the region. In some parts it is abundant. During the migrations I have noted it following the deciduous growth and nearby conifers along water courses, but when settled in its summer home, it is almost entirely restricted to the high conifers, a habit that seems to be followed even during rainy and stormy days. I am of the opinion that it must nest at a considerable height, for on several occasions I have seen the birds carrying material into trees at a height of over one hundred feet."

Taylor and Shaw (1927) write: "On entering the great forest of the Pacific Northwest, with its solitude, the deep-shaded grandeur of its brown-barked pillars and its stillness, one can almost imagine himself in a different world. Incessantly repeated, apparently from the very crowns of the trees, comes the song of the Townsend warbler, denizen of upper foliage strata. Found in early summer from Alaska south to the State of Washington, the Townsend warbler finds on Mount Rainier approximately the southern limit of its breeding range." Similar haunts seem to have been chosen wherever the species has been found breeding.

Spring.—The spring migration, apparently directly northward from Mexico, seems to be quite prolonged. Dr. Alexander F. Skutch tells me that the last of the winter visitors do not leave Guatemala until about the first of May. Professor Cooke (1904) says that "an early migrating Townsend warbler was seen on April 9 in the Huachuca Mountains of Arizona. Migrants from Mexico begin to enter southern California April 14 to 20. * * * First arrivals have been reported from Loveland, Colo., May 11, 1889." And "the average date of the first seen during five years at Columbia Falls, Mont., is May 7." Mrs. Amelia S. Allen writes to me from Berkeley, Calif., that Towsend's warbler is an abundant fall and spring migrant in California, where it is also a common winter visitant. "In the spring they begin to increase about the middle of March, when singing flocks go through the live oak trees, feeding on the small oak worms. They become less conspicuous after the middle of April, but if there are rains in the first half of May to delay migrations, occasional flocks are seen. My latest date is May 17, 1915."

Rathbun, in his Washington notes, writes: "In the spring of 1916, in the Lake Crescent region, a great majority of the individuals came in two distinct waves. The first occurred on April 28 and this lasted for two days, on the second of which the birds were less numerous. After an interval of a day on which we failed to see any of these warblers, there followed a second wave, on May 1, much larger than the one preceding. It consisted of hundreds of these warblers, together with individuals of other species, the main body of which followed the belt of deciduous trees along the shore of the lake. This fact we verified by ascending the adjacent mountain side to a considerable elevation during the movement, where we found but few birds. Descending to the lake level to note the migration, we found the birds close to the ground, the trees being of small size. As most of the Townsend's warblers were males in high plumage, the sight was most attractive. All were in constant song and flitting about with rapid movements. In their company were many chestnut-backed chickadees, a few Sitka kinglets, many Hammond's flycatchers, and now and then an Audubon's warbler and a red-breasted nuthatch. This movement began about half past eight in the morning and lasted until ten o'clock, when the number of birds began to diminish rapidly, and during the remainder of the day was inconsequential."

On April 25, 1917, he saw a similar flight at the same place. "The day was rather warm and somewhat overcast, and the wave continued intermittently throughout the greater part of the day, the song of Townsend's warbler being much in evidence most of the time. In this movement the birds passed by in small detached companies at intervals, but the aggregate number was large."

Nesting.—Not too much is known about the nesting habits of Townsend's warbler, but enough is known to indicate that nests reported in willows during the last century were evidently wrongly identified. The species is now known to nest only in firs, though possibly it may sometimes be found to select other conifers as nesting sites. Nests and eggs are still very scarce in collections.

The first authentic nests were found by J. H. Bowles (1908) near Lake Chelan, Wash., on June 20, 1908. The two nests, each containing four newly hatched young—

> were both placed about twelve feet up in small firs, one some five feet out on a limb, the other close against the main trunk. Both were saddled upon the limb, and not placed in a fork nor in a crotch.
>
> The construction of both nests was identical, and entirely different from any of the descriptions that I have read. They were firmly built, rather bulky, and decidedly shallow for the nest of a warbler. The material used appeared to be mostly cedar bark, with a few slender fir twigs interwoven. Externally they were patched with a silvery flax-like plant fiber, while the lining seemed to be entirely of the stems of moss flowers. To an eastern collector it resembled an unusually bulky and considerably flattened nest of the Black-throated Green Warbler, lacking any sign of feathers, however, in its construction.

A nest with five eggs is in the Thayer collection in Cambridge, taken by C. deB. Green on Graham Island, British Columbia, June 24, 1912. It is described as placed "on top of the big limb of spruce tree," and is large, compact, and well-built, being made largely of fine plant fibers, mixed with strips of grasses, mosses, lichens, fine strips of inner bark, plant down, and a few spider coccoons—all firmly woven together and neatly and smoothly lined with long, fine, white hairs and one feather. It measures externally 2¼ inches in height and 3 by 3½ in diameter; the cup is 1½ inches deep and about 2 inches in diameter.

A set in my collection now in the U. S. National Museum was taken by F. R. Decker in Chelan County, Wash., on June 23, 1923; the nest was about 15 feet up and 8 feet out on a limb of a fir tree and contained five fresh eggs. Both birds remained close while the nest was being taken. Two nests in the Doe Museum, at Gainesville, Fla., were taken by J. H. Bowles in Washington, 9 and 10 feet up in small, slender firs, June 2 and 4.

Eggs.—Either 3, 4, or 5 eggs are the numbers in the few recorded sets. The 5 eggs in the Thayer collection are ovate and have only a slight gloss. The white ground color is speckled and spotted with tones of "bay," "auburn," "chestnut brown," "Mars brown," or "russet," with undertones of "pale brownish drab," or "vinaceous drab." Some of the eggs have markings of two or three shades of the darker browns, such as "bay," or "auburn," while others have tones of a single lighter brown, such as "russet," interspersed with the drab spots. There is not a well defined wreath on any of these eggs, although the spots are denser at the large end. The measurements of 40 eggs average 17.4 by 12.9 millimeters; the eggs showing the four extremes measure 19.0 by 12.7, 17.3 by 13.6, 15.2 by 12.7, and 17.4 by 12.3 millimeters (Harris).

Plumages.—Maj. Allan Brooks (1934) gives the following good description of the juvenal plumage of Townsend's warbler: "Upper surface brownish olive, greener on dorsum and grayer on crown; lores and auriculars dusky brown, a broad supercilium and malar stripe whitish, faintly tinged with yellow; chin and throat dusky olive gray passing into white on the ventral region and crissum, the flanks and breast streaked with dusky; wings with two white bars formed by the tips of the greater and lesser coverts, tertials edged with ash gray, the black central shafts of the white bars seen in the second (first winter) plumage are barely indicated; tail as in second plumage."

Evidently the juvenal plumage is worn for only a very short time, for in the bird thus described, collected on July 7, "a few yellow feathers of the second plumage are appearing." Apparently, the postjuvenal molt is completed in July and August, and involves the contour plumage and the wing coverts only.

The young male in first winter plumage is similar to the old male at that season, but with less black on the head and throat, cheeks more olive, black streaks on back and sides obsolete, and yellow of the throat paler. The young female differs from the adult female in a similar way. There is evidently a partial prenuptial molt in late winter or early spring, but I have not been able to trace it. Apparently the black throat is acquired by the young male at this molt, and perhaps enough of the head and body plumage to make the young bird appear nearly adult, though the worn and faded juvenal wings and tail will distinguish it.

Adults have a complete postnuptial molt in July and August. Ridgway (1902) describes the fall and winter male plumage as "similar to the spring and summer plumage, but all the black areas much broken or obscured; that of the pileum and hindneck by broad olive-green margins to the feathers, the black forming mesial or central streaks, that of the auricular patch overlaid by olive-green tips to the feathers, and that of the throat replaced by nearly uniform lemon yellow, with black appearing as spots or blotches on sides of chest; black streaks on back, etc., more or less concealed." The adult female fall plumage is "similar to the spring and summer plumage, but upper parts slightly browner olive-green, with the streaks obsolete, or nearly so; sides and flanks tinged with brownish."

Although considerable wearing away of the concealing tips of the feathers occurs during the winter, thus brightening the nuptial plumage, there is evidently at least a partial prenuptial molt, especially about the head and throat, at which the clear black throat of the male is assumed and perhaps more of the body plumage renewed.

Stanley G. Jewett (1944) describes four specimens of adult males that are clearly hybrids between this species and the hermit warbler.

Food.—Professor Beal (1907) examined the contents of 31 stomachs of Townsend's warblers taken in California from October through January, of which he says: "The animal food consists of insects and a few spiders, and amounts to over 95 percent of the food during the time specified. Of this, bugs make up 42 percent, mostly stink-bugs (Pentatomidae) and a few leaf-hoppers and scales." Several stomachs were entirely filled with stink-bugs.

> Hymenoptera, consisting of both wasps and ants, are eaten to the extent of 25 percent of the food. Most of them are winged species. Perhaps the most striking point in the food of this bird is the great number of weevils or snout-beetles represented. They amount to over 20 percent of the food, while all other beetles form less than 1 percent. The greater number of these insects were of the species *Diodyrhynchus byturoides*, a weevil which destroys the staminate blossoms of coniferous trees. Five stomachs contained, respectively, 68, 65, 53, 50, and 35 of these beetles, or 271 in all. * * * Representatives also of another family of snout-beetles very destructive to timber were present in a few stomachs. These were the engravers (Scolytidae), which lay their eggs beneath the bark of trees, where they hatch, and the larvae bore in every direction. Caterpillars and a few miscellaneous insects and some spiders make up the remainder of the animal food.

The less than 5 percent of vegetable food "consists of a few seeds and leaf galls."

Gordon W. Gullion tells me that in Eugene, Oreg., from early January until the first of April 1948, Townsend's warblers were observed at a feeding station almost daily, eating cheese, marshmallows, and peanut butter.

Behavior.—A marked characteristic of Townsend's warblers is their fondness for the tree tops, especially on their breeding grounds and to some extent at other seasons. In the coniferous forests which they frequent in summer, they confine their activities almost entirely to the tops of the tallest fir trees, where they travel rapidly, stopping only long enough to glean their food and then hastening onward, returning, perhaps, over the same trees in their active restless foraging.

Later in the summer and as migration time draws near, they are frequently seen at lower levels, among deciduous trees and in second growth woods, often in association with kniglets, chickadees, other warblers, and juncos.

Voice.—Mrs. Allen (MS.) renders the song as a "*weazy weazy weazy weazy tweea*, rising in spirals, and the call-note a soft *chip*, not so metallic as the lutescent's, and less emphatic than the Audubon's." According to Rathbun (MS.), "its song is heard during May and June quite persistently under all climatic conditions." Dr. Merrill (1898) says that the song, as he heard it in Idaho, "usually consists of five notes, *deé deé deé—dĕ dĕ*, all, especially the first three, uttered in the peculiar harsh drawl of *D. virens.* Later in the season this song changes somewhat." This second song was heard in low second growth. Mr. Rathbun also refers in his notes to a different song, heard in some young second growth; the bird was "singing softly as if to itself, this being a much more finished performance than the ordinary song, although identical in construction, the distinction being an elaboration of the song in full in softer tones." Ralph Hoffmann (1927) found the song of Townsend's warbler difficult to distinguish from that of the black-throated gray warbler. "The Townsend Warbler's song has less of the drawling inflection in the opening notes than the Black-throated Gray's and often ends with a prolonged *ee-zee*. A song noted by the writer in the Olympics in western Washington was transcribed as a hoarse *swee swee swee zee.*"

Field marks.—The adult male Townsend's warbler is distinctively marked, having the crown, cheeks, and throat black, with bright yellow spaces between these areas, and an olive-green back and bright yellow breast, both streaked with black; it has two prominent white wing bars and considerable white on the outer tail feathers. The female has a similar pattern, but the colors are much duller and she has no black throat. Young and adults in the fall are much like the adult female in spring, but are more or less clouded with brownish. There is no other western warbler that is much like it.

Fall.—Theed Pearse tells me that he has seen Townsend's warblers on migration through Vancouver Island, British Columbia, as early as August 13 and as late as October 9, but gives no winter records. Rathburn gives me two winter records for the vicinity of Seattle, Wash.; D. E. Brown took two males on January 9, 1921, and saw "a number of others"; and a week later he collected a female. These were doubtless, winter casuals, as the summer residents and transients pass through Oregon in October or earlier.

Mrs. Allen writes to me from Berkeley, Calif.: "The Townsend Warbler is an abundant fall and spring migrant and a common winter visitant. In Berkeley the average date of arrival in the fall is September 28 (18 records), the earliest August 27, 1931. They are most abundant during October, after which they are reduced to winter numbers."

Henshaw (1875) writes:

> At Mount Graham, Ariz., in September, this warbler was found in considerable numbers, though the few taken were procured with no little difficulty, for they almost invariably were seen in the tops of the tallest trees, where a glimpse might now and then be had of them as they dashed out after flying insects, or flew from tree to tree in their always onward migratory course. The tracts of pine woods they shunned entirely, but affected the firs and spruces, and their flights from point to point were regulated and made longer and shorter by the presence or absence of these trees. Their movements were exceedingly rapid; a moment spent in passing in and out the interlacing branches, a few hurried sweeps at their extremities, and they were off to the next adjoining tree to repeat the process again and again till lost sight of in the dense woods.

Winter.—A few straggling Townsend's warblers spend the winter occasionally as far north as Oregon and Washington; the species is fairly common from central California southward; but the main body of the species retires to Mexico and Central America. Mrs. Allen tells me that they are quite abundant in the redwood trees of California in winter; and in midwinter, she has "many records of their coming under the eaves of the house, where they seem to be taking spiders."

Dr. Skutch has contributed the following account: "Townsend's warblers winter in vast numbers in the highlands of Guatemala. From their arrival in September until shortly before the departure of the last in May, I considered these the most abundant of all birds, whether resident or migratory, between 7,000 and 10,000 feet above sea-level on the Sierra de Tecpán in west-central Guatemala. Here they were almost equally numerous in the forest of pine, oak, alder and arbutus and in the nearly pure stands of lofty cypress trees (*Cupressus benthamii*) on the mountain-top. But they are widespread over the Guatemalan altos, from 5,000 to 10,000 feet above sea-level, and even pass the winter at considerably lower altitudes, where pine woods locally replace the broad-leafed forest prevalent in these less elevated regions. Thus on the Finca Mocá, a huge coffee plantation lying on the southern side of the Volcán Atitlán, a local stand of pine reaches to about 3,000 feet above sea-level. Among these pines I found Townsend's warblers wintering down to at least 3,400 feet, in company with such birds as hermit warblers and Coues' flycatchers—all of them highland species which I failed to find at so low an altitude in the neighboring dicotyledonous woods more typical of the region.

"By the time the Townsend's warblers began to arrive from the North, the great majority of the resident birds of the Sierra de Tecpán had finished breeding for the year, and those of sociable habits had begun to flock. The pretty Hartlaub's warblers (*Vermivora superciliosa*) formed the nuclei of the mixed companies of small birds which roamed through the rain-drenched woods at the beginning of September. The newly arrived Townsend's warblers at once joined these flocks, falling in with the resident birds as though they had never been absent in far northern lands. Soon they outnumbered all other birds in these motley parties. They were monotonously abundant; and despite their beauty, I was more than once exasperated, when I had striven until my neck ached to obtain an adequate glimpse of some small, elusive bird flitting through the high treetops, to find at last that it was just one more Townsend's warbler. There was always another of the same kind much lower among the branches, which I might have admired with less flexure of the neck! At 5,000 feet and below, the plainly attired Tennessee warbler replaces the elegant Townsend's warbler as the most abundant member of the mixed flocks.

"By the middle of April, the Townsend's warblers on the Sierra de Tecpán began to sing—a dreamy, lazy sort of song, which reminded me much of that of the black-throated green warbler. Through the remainder of the month, I repeatedly heard this simple song, sounding always as though it came from far away. Soon the ranks of the Townsend's warblers began to thin; and after May 2 I saw them no more. Males were present as late as April 28; but the last that I saw, on May 2, was a female. The withdrawal of the countless black-and-yellow warblers, together with that of the other migratory species that flocked with them, left a void among the treetops, which was not filled until their return just 4 months later.

"Early dates of fall arrival in Guatemala are: Guatemala City (Anthony), September 7; Sierra de Tecpán, September 2, 1933; Huehuetenango, September 11, 1934. Late dates of spring departure from Guatemala are: Guatemala City (Anthony), May 1; Sierra de Tecpán, May 2, 1933."

Dickey and van Rossem (1938) say that "Townsend's warbler is a decidedly uncommon species in El Salvador, which probably marks about the southern limit of the winter range. The winter distribution, locally, is practically confined to the oaks and pines of the interior mountains where conditions most closely parallel those prevailing in the breeding range."

DISTRIBUTION

Range.—Western North America.

Breeding range.—Townsend's warbler breeds **north** to southern Alaska (Seldovia, Port Nell Juan, and Cordova); and southern Yukon (Lapie River and Sheldon Lake). **East** to eastern Yukon (Sheldon Lake and Lake Marsh); central to southeastern British Columbia (Atlin, Bear Lake, Tacla Lake, and Revelstoke); southwestern Alberta (Banff National Park); and western Montana (Fortine, Columbia Falls, Great Falls, and Red Lodge). **South** to central southern Montana (Red Lodge); northwestern Wyoming (Mammoth Hot Springs); northern Idaho (Falcon and Moscow); and southern Washington (Blue Mountains, Preston, and Mount Adams). **West** to western Washington (Mount Adams, Mount Rainier, Seattle, and Bellingham); western British Columbia (Comox, Vancouver Island, and the Queen Charlotte Islands); and southern Alaska (Craig, Baranof Island, Glacier, Cordova, and Seldovia).

Winter range.—The Townsend's warbler is found in winter in two widely separated areas. It is found in varying numbers in the coastal region of California from Mount St. Helena, Sonoma County, south to San Diego, and on the Santa Barbara Islands. A specimen collected at Patagonia, southeastern Arizona on December 3, may have been wintering. It also winters in the mountains of western Mexico and Central America from Guerrero (Tlalixtaquilla); and the Federal District (Tlalpan); through Oaxaca (La Parada and Totontepec); Guatemala (Huehuetenango, Tecpán, Dueñas, and Guatemala); El Salvador (Los Esesmiles and Mount Cacaguatique); to central northern Nicaragua (Matagalpa).

Migration.—Late dates of spring departure are: El Salvador—San José del Sacore, March 16. Guatemala—Tecpán, May 2. Nayarit—Tres Marías Islands, May 11. Sonora—Oposura, May 31. Texas—Boot Spring, Chisos Mountains, May 16. New Mexico—Rinconada, May 6. Arizona—Rock Canyon, Santa Catalina Mountains, May 25. California—Buena Vista, May 10.

Early dates of spring arrival are: Hidalgo—Jacala, March 28. New Mexico—Apache, April 23. Arizona—Tombstone, April 3. Colorado—Loveland, May 11. Wyoming—Cheyenne, May 11. Montana—Columbia Falls, May 4. Idaho—Coeur d'Alene, April 29. Oregon—Sutherlin, April 21. Washington—Bellingham, April 25. British Columbia—Courtenay, March 28; Atlin, May 18. Alaska—Craig, April 27.

Late dates of fall departure are: Alaska—Ketchikan, September 5. British Columbia—Atlin, September 1; Okanagan Landing, September 15. Washington—Tacoma, October 3. Alberta—Jasper Park, September 8. Idaho—Priest River, September 10. Montana—Missoula, August 31. Wyoming—Laramie, October 18. Colorado—Fort Morgan, October 12. Utah—Bryce Canyon, October 7. Arizona—Mineral Creek, Pinal County, November 2. New Mexico—near Corona, October 18. Oklahoma—Kenton, September 27. Texas—Glenn Springs, Brewster County, October 19. Chihuahua—Durazno, November 7.

Early dates of fall arrival are: Oregon—Fremont National Forest, August 20. California—August 26. Utah—Beaver Creek Canyon, August 10. Arizona—San Francisco Mountain, August 21. Wyoming—Laramie, August 11. Colorado—Estes Park, August 14. New Mexico—Apache, August 2. Texas—Pulliam Canyon, Chisos Mountains, August 26. Chihuahua—Saltillo, August 28. Guatemala—Tecpán, September 2. El Salvador—Divisadero, September 27.

Casual records.—On May 12, 1868, a Townsend's warbler was collected near Coatesville, Pa. A female sepcimen was collected September 17, 1939, at Gulfport, Miss. On August 18, 1934 one was reported seen at East Hampton, Long Island; another was closely observed by several competent observers in Prospect Park, Brooklyn, N. Y., May 8 to 10, 1947.

Egg dates.—British Columbia: 2 records, June 7 and 24.

Oregon: 3 records, June 7 to 21.

Washington: 18 records, May 24 to June 24; 9 records, June 8 to 19, indicating the height of the season (Harris).

DENDROICA VIRENS VIRENS (Gmelin)

NORTHERN BLACK-THROATED GREEN WARBLER

PLATES 36–38

HABITS

The northern black-throated green warbler I have always associated with the white pine woods, the delightful fragrance of fallen pine needles carpeting the forest floor, and the murmuring of the warm summer breeze. The song has been written as "trees, trees, murmuring trees," appropriate words that seem to call vividly to mind the pretty little bird in its sylvan haunts and its delicious and soothing voice.

In southeastern Massachusetts, from late April until after midsummer one can seldom wander far in the thick groves of white pine (*Pinus strobus*), either in the open stands or in mixed woods where these pines predominate, without hearing the delightful drawling notes of this warbler, though the tiny singer in the treetops is not so easily seen. It is not, however, exclusively confined even in the breeding season to such woods, for sometimes we find it in open stands of pitch pines (*Pinus rigida*) or in old neglected pastures and hillsides where there is a scattered growth of red cedars (*Juniperus virginiana*).

Gerald Thayer wrote to Dr. Chapman (1907) that, in the Monadnock region of New Hampshire, the black-throated green warbler is "a very common or abundant summer bird through all the region, high and low; ranging from the pine woods of the lowest valleys to the half open copses of spruce and mountain ash along Monadnock's rocky ridge—2,500 to 3,160 feet. * * * Though decidedly a forest Warbler, it favors second growth, and pasture-bordering copses, rather than the very heavy timber, and is particularly partial to dry white pine woods."

Farther north, in the Canadian Zone, these warblers are at home in the forests of spruce and fir, but even here they seem to prefer pines, if they can find them, for Ora W. Knight (1908) says that in Maine "in the breeding season they resort to the pine woods by preference, and as a result are rather common in the pine barrens of the coastal plain. Inland the species is common, and while preferring the pines still, also occurs in rather open mixed woods where cedars, hemlocks and spruces predominate, and in northern Maine is found in spruce woods, seemingly because no other kinds are available."

Farther west, in northern Michigan, this warbler breeds on the open jack pine plains and in mixed growths containing a fair percentage of other conifers. Frank A. Pitelka (1940b) writes: "During the breeding season the Black-throated Green Warbler is one of the more frequent Compsothlypids in the conifer regions of northern lower Michigan, though it is by no means to be included among the common birds. Locally it occurs in spruces of mature bog communities and in upland developmental forests of mixed pine and deciduous growth."

In western Pennsylvania, "its local breeding range is correlated rather closely with the distribution of the white pine and the hemlock. Where these conifers prevail, the Black-throated Green appears, although in the mountains it is by no means averse to hardwood timber, if high and dense" (Todd, 1940). And, in the Pymatuning Swamp region, "wherever tall black birches and equally tall, slender hemlocks grew side by side, the Black-throated Green Warblers were almost sure to be found, and no less than twenty pairs were located" (Sutton, 1928). Referring to the central Allegheny Mountain region, Prof. Maurice Brooks (1940) says that "this species, in its distribution within our area, presents one of the most puzzling problems with which we have to deal. It occurs everywhere at high elevations, in spruce, hemlock, northern hardwoods, white pine, oak-pine scrub, and oak-hickory."

Still farther south, on Mount Mitchell, in western North Carolina, Thomas D. Burleigh (1941) found it to be "a plentiful breeding bird in the thick fir and spruce woods at the top of the mountain, appearing in April when the ground is frequently still covered with snow and lingering in the fall until early October."

Spring.—From its winter home in Mexico and Central America, the black-throated green warbler, starting early in March, migrates northward through eastern Texas and up the Mississippi Valley, mainly in the forested areas. I noted it in the great wave of warblers migrating along the Texas coastal islands early in May. The fact that it is so rare in southern Florida, and still rarer in Cuba, suggests that many individuals must make the perilous flight from Yucatan across the Gulf of Mexico to the Gulf States. From Louisiana it takes a more northeasterly route, mainly along the Alleghenies, to New England and beyond. It is one of the earlier warblers to arrive in Massachusetts, often during the last week in April. The birds come along in waves, the first wave consisting mainly of males and later waves containing the females in larger numbers. The passage of individuals seems to be fairly rapid, but the species may be present for nearly a month at any point along its migration route. While migrating it may be seen, like other warblers, almost anywhere—in the tops of woodland trees, in roadside trees and shrubbery, in gardens and in parks, before it settles down in its favorite breeding haunts. There must be a very heavy migration through Ohio, for Milton B. Trautman (1940) says that in the "larger flight 50 to 125 were daily recorded, and it was evident that there were several thousands present."

Nesting.—Although the black-throated green warbler is one of our commonest breeding warblers, I have never found its nest in my home territory, though I have spent many hours hunting for it in its favorite pine woods. While hunting through a somewhat open tract of pitch pines on Martha's Vineyard, Mass., on June 8, 1919, with Frank C. Willard, we found a nest with four fresh eggs 8 feet from the ground in a small pine; it was saddled on an upward-slanting limb and partially supported by a whorl of three small branches. It was a pretty nest, made of grasses, seaweed, and strips of inner bark, and was lined with fine grasses, cowhair, horsehair, and a few white feathers. The male was incubating and was very tame, coming within a few feet of us; he also returned and sat on the empty nest after Mr. Willard had removed the eggs.

On June 4, 1910, Herbert K. Job showed me a nest near New Haven, Conn., in mixed deciduous woods; it was about 11 feet from the ground, built against the trunk of a large chestnut sprout and supported by a small dead branch and two live twigs; the leaves on this twig screened the nest from above, one leaf forming a complete canopy over the nest, the tip of it being tucked into the rim. It was made largely of materials similar to those in the one previously described, there being three large feathers on the rim and many small feathers in the lining.

The only other nest I have ever seen was found on the island of Grand Manan, New Brunswick, on June 11, 1891; it was placed only 3 feet from the ground between two horizontal branches and against the trunk of a small spruce beside a cowpath in coniferous woods. It was a compact, deeply hollowed, structure made of fine twigs, mosses, birch bark, strips of inner bark, and weed stems, and it was lined with white cowhair and a few feathers.

There is a set in my collection, given to me by Fred H. Carpenter, said to have been taken from a nest only 8 inches from the ground in a small red cedar in an old neglected pasture in Rehoboth, Mass. The nest, now before me, seems to be typical of the species.

The nests mentioned in some notes sent to me by Miss Cordelia J. Stanwood, of Ellsworth, Maine, were in spruces or hemlocks at low or moderate heights, but Knight (1908) says that "near Bangor the species builds fifty to seventy feet up in the larger, taller pine trees." Robie W. Tufts tells me that, of some 20 or 30 nests that he has seen in Nova Scotia, "all have been built in conifers, including hemlock, spruce, and pine." In New York and Pennsylvania, hemlocks seem to be the favorite nesting trees, but nests are sometimes placed in beeches or yellow birches; the nests in hemlocks are usually placed on horizontal branches at a considerable height from the ground and generally well hidden in the foliage. A nest examined by Dr. George M. Sutton (1928) at Pymatuning Swamp "was saddled on a horizontal bough only about twenty-five feet from the ground, in a comparatively small hemlock. The nest was very deep and beautifully constructed, its lining including bits of hair, fur, and soft feathers, and its foundational material consisting chiefly of slender and uniform twigs of dead hemlock."

The two nests studied by F. A. Pitelka (1940), in northern lower Michigan, were on horizontal branches of Norway pines (*Pinus resinosa*), 23 and 12 feet from the ground, respectively. The materials used in the nests were largely similar to those mentioned above, with the addition of woollike plant fibers and short pine twigs in the lining, and with "a considerable quantity of hypnaceous mosses and bits of birch bark" used as trimmings.

Dr. Paul Harrington writes to me: "I have found this bird nesting in pure deciduous forests on two occasions." One nest was 40 feet up in the crotch of an ironwood, and the other was 20 feet from the ground in a small elm, both in Ontario. Edward R. Ford has sent me the following note: "On Gull Island, about ten acres in extent, which lies in northwestern Lake Michigan, we found the black-throated green warbler in an unusual nesting niche. About half of the island's area is northern hardwood forest, whose floor cover is largely of American yew (*Taxus canadensis*). At a height of but two or three feet, among the sprays of this ground-hemlock, we discovered two nests of the species named. Each of these, July 12, 1918, held four eggs. There was a third nest, empty but evidently used that season."

Nests have also been found in maples, in white, gray, and black birches, in alders and probably in other deciduous trees and bushes. And the following unusual nesting sites are of interest: William Brewster (1906) mentions a nest that he found "in a barberry bush growing in an open pasture at Arlington Heights, one hundred yards or more from the nearest woods." He also has a nest, taken by C. H. Watrous in Connecticut, that was on the ground "among a large clump of ferns in a very low and damp place under a heavy growth of hemlocks" (Brewster, 1895). John C. Brown (1889), of Portland, Maine, mentions a nest that was built in a grapevine growing luxuriantly about a pagoda at some distance from any woods; it was well hidden from the outside by the foliage, but in plain sight from inside the pagoda. And B. S. Bowdish (1906) records a New Jersey nest that "was built between the stems of a 'skunk cabbage' plant, and fastened to a catbriar and the twigs of a dead bush, and was about fourteen inches from the ground, in a very wet part of the swamp."

Miss Stanwood (1910) watched a pair of black-throated green warblers building a nest in a fir tree, of which she writes:

> First they laid knots of spider's silk and little curls of white birch bark in the shape of the nest, on the horizontal fork about midway of a branch six feet long. Next bits of fine grass, a little usnea moss, and cedar bark fibre. Both the male and female worked on the nest, until observed, the female shaping it with the breast each time they added a bit of material. Around the top were carefully laid the finest gray spruce twigs. These were bound together with masses of white spider's silk. The white curls of birch bark, the much weathered twigs, the fluffy shining bands and knots of spider's silk, made a very dainty looking structure. After the first morning, I did not see the male about the nest. As a general thing, I find that, if birds are observed building, the male usually leaves his part of the work to the female. The lady bird continued to shape the nest with her breast, turning around and around, as if swinging on a central pivot, just her beak and tail showing above the rim. If I came too near, she stood up in the nest as if to fly. If I withdrew to a respectful distance, say three yards, she went on with her work of shaping the nest. On the second day the rim of the nest seemed about completed. It was narrower than the rest of the cup and beautifully turned. Nothing to speak of had been done to the bottom. On the fourth day, by touching the inside of the nest with the tips of my fingers, I judged that the lining was about finished. It consisted of rabbit-hair and horse-hair, felted or woven together so as to be very thick and firm. Between the foundation of twigs and bark and the hair lining was a layer of fine hay of which the mouth of

the nest was chiefly shaped. I never saw a more substantial looking little nest. It was also one of the most beautiful I have ever found, a perfect harmony in grays.

A very pretty nest in my collection is largely made, externally, of usnea and is profusely decorated with masses of the curly outer bark of the yellow birch. The larger of two nests before me measures about 4 by 3½ inches in outer diameter, the smaller about 3 inches; both are about 2 inches high, nearly 2 inches wide and 1½ deep inside.

Eggs.—The black-throated green warbler usually lays 4 eggs to a set, but quite often 5. These are ovate to short ovate and slightly glossy. The ground color is grayish white or creamy white. The markings consist of specks, spots, blotches, or small scrawls of reddish browns, such as "auburn," "chestnut," "bay," "Mars brown," or "russet," with underlying spots of "light brownish drab," "deep brownish drab," or "light purplish drab." Generally the markings are concentrated at the larger end, where they usually form a wreath, but occasionally the spots are well scattered over the entire egg. There is considerable variation. Some eggs have a faint wreath of the pale drab coloring which is relieved with a few bold spots or scrawls of dark "bay" or "Mars brown." Others are richly spotted and blotched equally with browns and drabs, or they may have a solid ring of "russet" blotches which completely covers and conceals the drab undertones. The measurements of 50 eggs average 17.0 by 12.7 millimeters; the eggs showing the four extremes measure **18.8** by 12.8, 17.2, by **13.4**, **15.5** by 12.2, and 18.0 by **12.0** millimeters (Harris).

Young.—It is generally conceded that the period of incubation is about 12 days and that the young remain in the nest from 8 to 10 days, depending on the amount of disturbance. Probably the female does most, or all, of the incubating and brooding, but both sexes assist in feeding the young and in swallowing or removing the fecal sacs. Miss Stanwood (1910b) refers to the development of the young as follows: "On the third day the young birds grow rapidly, burnt-orange in color, covered with an abundant supply of burnt-umber down. The quills and pin feathers showed blue-gray through the skin, and the eyes were just beginning to open." At another nest, "on the eighth day, the nest was simply stuffed full of little green-gray birds, strikingly like the color of the nest.

* * * On the eleventh day, quite early in the morning, as I neared the nesting place, I heard the fledglings calling from the treetops. Soon I caught a glimpse of the Black-throated Green Warblers marshalling their little band away."

Margaret M. and L. B. Nice (1932) made detailed studies of two nests of this warbler, to which the reader is referred. I quote from their summary:

> 1. The young in the first nest were raised with no assistance from the male until the last two days, when he brought 11 meals in contrast to his mate's total of more than 245. The young in the second nest were raised entirely by the female. 2. The first female incubated for periods ranging from 34 to 50 minutes, absenting herself for periods ranging from 9 to 26 minutes. The second female once incubated for 99 minutes at a stretch; her absences varied from 13 to 20 minutes. 3. Both females brooded for longer periods than the majority of arboreal Warblers that have been studied, averaging 15.1 and 18.3 minutes respectively. 4. Both females fed at slow rates, the average for the first being once in 19.7 minutes, for the second once in 16.3 minutes. * * * (6). Both females made definite efforts to get their last young out of the nest and to lead them to a distance.

Pitelka (1940b) gives many interesting details on the home life of the black-throated green warbler, illustrated with charts and tables that are not suitable for inclusion here, but his paper is well worth careful study.

Reading and Hayes (1933) made some intimate studies of these warblers at their nest; referring to the food of the young, they say: "Observations at less than two feet revealed the tremendous value of these birds as insect destroyers. Spiders, mayflies, green caterpillars (Anisota), ants, small noctuid moths, ichneumon flies, crane flies, and many smaller diptera made up the whole of their menu. While the few spiders and ichneumon flies were harmless or possibly beneficial, many of the other insects were injurious."

Plumages.—Dr. Dwight (1900) calls the natal down sepia-brown and describes the juvenal plumage, in which the sexes are alike, as "above, sepia-brown or drab. Wings and tail dull black, edged with ashy or olive-gray; two wing bands white; the outer three rectrices largely white. Below, dull white, dusky on the throat, spotted on the breast and sides with dull olive-brown. Indistinct grayish white superciliary line. Dusky transocular streak."

A partial postjuvenal molt, beginning in July and involving the contour plumage and the wing coverts but not the rest of the wings or the tail, produces the first winter plumage, in which the sexes are distinguishable. He describes the young male as—

> above, greenish olive-yellow, the upper tail coverts ashy or plumbeous gray edged with olive yellow. The feathers of the crown and back especially have concealed black shaft streaks. The wing coverts are black, edged with olive green; two broad white wing bands tipped faintly with yellow. Below, faint primrose-yellow, white on the crissum; the breast and a spot on the flanks canary, the chin, sides of head and neck and superciliary line bright lemon-yellow; a variable area on the throat seldom including the chin, black, veiled by long narrow edgings, the sides and flanks broadly streaked and similarly veiled. Transocular and rictal streaks dusky; lores grayish. * * * In first winter plumage the female is browner than the male, without the black throat and the side streaks obscure; some specimens with much black may, however, easily be mistaken for dull first winter males.

The first nuptial plumage is acquired by a partial prenuptial molt, "which involves chiefly the head, chin and throat and not the rest of the plumage. The black chin is assumed by the male and the forehead becomes yellower by moult, wear removing the edgings everywhere so that the streakings below and the throat become jet-black. Young and old become practically indistinguishable, except that the wings and tail of the young bird will average browner and more worn with the edgings duller." In the female, "the first nuptial plumage differs very little from the first winter, wear bringing out the streaking, while a few feathers are assumed by moult on the chin."

A complete postnuptial molt occurs in July, producing the adult winter plumage, in which the male "differs somewhat from the first winter, the black of the throat extending uninterruptedly to the apex of the chin, further down on the throat, and in broader stripes on the sides; the wings and tail are blacker and the edgings grayer, especially on the tertiaries; the concealed black of the back more extensive. The veiling is conspicuous on the throat." The adult winter female is much like the first winter male, "and may have considerable black on the throat, and even the chin."

The adult nuptial plumage is acquired mainly by wear, with only slight indications of molt, as in the young bird. Dr. Dwight says of the female: "The adult nuptial plumage is, in extreme examples, hardly distinguishable from the male, but usually the black is much restricted and the chin yellow, merely spotted with black."

Food.—We have only scattering reports on the food of the black-throated green warbler. S. A. Forbes (1883) examined the stomach of one taken in an orchard infested with canker-worms in Illinois, and found it to contain 70 percent of these destructive caterpillars, 15 percent beetles, 5 percent Hemiptera, and the remaining 10 percent Hymenoptera, gnats, coleopterous larvae and mites. Five stomachs of Nebraska birds, collected by Professor Aughey (1878), contained an average of 23 locusts and 21 other insects. Of twelve specimens examined by F. H. King (1883) in Wisconsin, "one had eaten a moth; three, seven caterpillars; one, two diptera; one, six larvae—probably caterpillars; three, eleven beetles; and one, a heteroptera."

Knight (1908) from Maine writes: "The food consists almost entirely of insects, including beetles, flies, moths, spiders, grubs, larvae and in general the sorts of insects found on the limbs and foliage of the various evergreen trees and especially on the pines. Only rarely do they take their prey in the air, preferring to diligently seek it out among the branches and foliage."

Probably all the items mentioned in the food of the young are also eaten by the adults. Forbush (1929) adds to the list leaf rollers, leaf-eating caterpillars of various kinds, and plant-lice. Evidently these warblers are among the best protectors of our forest trees. W. B. Barrows (1912) says that they are "particularly fond of the berries of the poison-ivy, and to a less extent of those of the junipers." J. K. Terres (1940) saw them tearing open the nests of tent caterpillars, devouring large quantities of the larvae, which were about three-quarters of an inch long.

Behavior.—Although the black-throated green warbler is one of our tamest and most confiding wood warblers, as shown by the intimate studies of its home life made by several observers, it is much more often heard than seen, for it is a tiny mite and spends most of its time in the tree-tops, gleaning in the foliage of both coniferous and deciduous trees. As Miss Stanwood (1910b) says: "The bird is quick in its movements, but often spends periods of some length on one tree, frequently coming down low to peep inquisitively at an observer, once in a while flying toward a person as if to alight on his hand or head." Forbush (1929) draws a picture of its confidence: "Like all the wood warblers it is fond of bathing, its bath tub often some pool in a mountain trout brook. One day as I stood beside such a brook, a very lovely male, disregarding my presence, alighted on a stone at my feet, and at once hopped into the clear spring water and performed his ablutions, dipping into the stream and throwing off the sparkling drops in little showers. As he stood there in the sunlight which streamed through an opening in the tree-tops, he left an enduring picture in my memory."

Those who have studied the home life of the black-throated green warbler have noted its intolerance of some avian intruders in the vicinity of its nest, and its tolerance of others. Pitelka (1940b) writes:

> On the eighth day after the hatching, a red squirrel (*Sciurus hudsonicus*) was observed to approach the blind, coming to within seven feet of the nest. At this time, the female simply left the vicinity of the nest at once and gave no alarm notes. Later the same day, when a young Black and White Warbler approached the nest to a distance of five feet, the female pounced upon it and struck with considerable force. When the intruder returned a second time the female flew at it and drove it away. The indifference to red squirrels and at the same time the offensive reaction toward small passerine intruders (*Vireo olivaceus* and *Penthestes atricapillus*) has also been noted by the Nices (1932: 160).

Reading and Hayes (1933) write: "While at the nest, we noticed an inquisitive Chestnut-sided Warbler in a maple a short distance away. He hung around for several minutes, peering at us, until suddenly the male, ably seconded by his mate, attacked him and drove him off. A male Blackburnian met the same fate a little while later, while peacefully hunting insects in the big spruce and, about an hour after that a Red-eyed Vireo changed his intended route at the first warning note and promptly withdrew. Curiously enough, a small family of Black-capped Chickadees travelling slowly through the spruce was totally disregarded."

The black-throated green warbler is seldom bothered by the cowbird, although mentioned by several writers as imposed upon.

Voice.—Aretas A. Saunders has sent me the following full account of the two songs of the black-throated green warbler: "The quality of the songs is sweet and musical and exceedingly pleasing. With the possible exception of the yellow warbler, this species has the most attractive of the *Dendroica* songs. The quality has something indescribable that is all its own and enables those familiar with it to recognize the song, however variable the form.

"The black-throated green warbler has two distinct forms of song. Both may be sung by the same individual, and both are equally common in the migration and through the nesting season, so that they cannot be considered as territory and nesting songs. I distinguish them as first and second, but my choice is purely arbitrary. Both are delivered in the same quality. The first is a little longer than the second, for it contains more notes; but it is not proportionately longer, for the notes are shorter.

"The first song has notes on three different pitches. The first notes, three to nine but commonly four or five, are all on the same pitch, usually the highest; the next note, usually a major third lower, is the lowest; the next, and last, is between them. Such a song might be written *sree sree sree sree sree tro tray*, all the notes being of equal length. I have 34 records of this song, 23 of which follow this form. A few are arranged with the last note highest, or lowest, or on the same pitch as the first. The first notes are sometimes varied by alternating short and long notes or sometimes are united in a long trill.

"The second song consists of four or five notes only, with a definite time arrangement—3 2 1 1 or 3 2 1 1 1; that is, the first note is three times as long as the last and the second note twice as long. The third and fourth notes are on the same pitch, but the others are on different pitches, so that the song might be written *treee tray to to*, or a 5-note song *treee tray tray to-to tay*. The notes, as in the first song, are on three different pitches, but they vary in every possible way as to which note is highest and which lowest, so that there are six possible arrangements of these different pitches in a 4-note song where the last two notes are always on the same pitch. In my collection of 52 records of this song I have samples of all six, and of these 33 are of four notes, while only 19 have the fifth note added.

"Songs of this species vary from 1⅕ to 2 seconds in length, the first song from 1⅖ to 2 seconds, and the second 1⅕ to 1⅘ seconds. The pitch varies from F‴ to E⁗, a half tone less than an octave. One peculiar song of the first type, however, was prefixed by a wrenlike chatter that was pitched on B″, but the remaining song was normal in pitch. Single songs average about one and a half tones in range, but the majority of the songs of the first type range two tones, and those of the second type two and a half tones.

"The song is to be heard from the first arrival of the species in migration until shortly after the first of August. In 14 seasons the average date of late song in Allegany State Park is August 2, the earliest is July 25, 1927, and the latest August 11, 1935 and 1937. While there is no regular revival of full song after the molt, there is occasional singing of a primitive character."

C. Russell Mason tells me of a song in which the high, musical note was given six times instead of the usual once. Francis H. Allen has heard some variations in the songs and has sent me these notes: "One bird added at the end of the familiar *zee zee zee zoo zee* a coda of an intricate and wrenlike quality, and sang this beautiful song constantly. Another introduced a trill after the second note of the 'trees, trees' song and ended it with a low note. Another bird sang a variant of the 'trees, trees' song, in which it substituted for the final high note a lower-pitched *su-eet su-eet* without the familiar *z* quality." He and Dr. W. M. Tyler heard one that "sang in addition to one of the characteristic songs of the species an entirely unrecognizable one that went something like *ti-ti-ti-ti-ti-zp*. The first five notes were very thin and slight with a very short pause before the last one, and the final note was a short emphatic buzz. Once this song ran into a characteristic song without a pause between." He refers to the ordinary call-note as a distinctive *chet*, suggesting that of the myrtle warbler, but thinner. "On the occasion in early June, I heard from a male bird a succession of chippering notes which I had formerly attributed to the young alone. He alternated these notes with singing."

Many other somewhat similar renderings have appeared in print, both in syllables and in human words, most of which seem to recall the song to mind. Some of the best of the wordings are *trees, trees, murmuring trees* and *sleep, sleep, pretty one, sleep* (Torrey, 1885); *good Saint Theresa* (Maynard, 1896); and *take it, take it, leisure-ly* (Stanwood, 1910b). Miss Stanwood pays this tribute to the charm of the song: "His voice is suggestive of the drowsy summer days, the languor of the breeze dreamily swaying the pines, spruces, firs, and hemlocks. It recalls the incense of evergreens, the fragrance of the wild strawberry, the delicate perfume of the linnea. No other bird voice is so potent to evoke that particular spell of the northern woods."

The black-throated green warbler is a most persistent singer. The Nices (1932) say that the first warbler "gave 466 songs in a single hour and more than 14,000 in the 94 hours of observation." According to Albert R. Brand (1938), the approximate mean number of vibrations per second in the song is 6,025, in the highest note 6,750 and in the lowest note 5,125. This compares with a mean of 8,900 for the black-polled warbler, which is the shrillest passerine bird song.

Field marks.—The conspicuous, bright yellow cheeks, the olive-green back, the prominent black throat, the two white wing bands, and the white outer webs of the lateral tail feathers will distinguish the male in breeding plumage. The female is duller and has less black, or none at all, on the throat. Young birds in the fall are much like the female. See the descriptions under Plumages.

Fall.—The fall migration of the black-throated green warbler begins during the latter part of August, continuing through September and often through much of October. It seems to be a reversal of the route followed in the spring. Similar haunts are frequented in the fall in the company of vast congregations of other species. A remarkable flight of various species of warblers was seen by Rev. W. F. Henninger in Scioto County, Ohio, an account of which is quoted by W. L. Dawson (1903) as follows:

> On September 28, 1899, I ran into a company of warblers which I would place conservatively at two thousand individuals. It was like a regular army as it moved up a long sloping hillside, and with wonderful rapidity. The wind was blowing almost a gale from the north, and the birds allowed themselves to be urged before it in the direction of their ultimate retreat, like half-stubborn autumn leaves. Lisping, chipping, whirling, driving, they hurried on and I after at full speed, panting, and wishing devoutly for a better chance to identify the fleeing forms. Arrived at the top of the hill the army suddenly halted and when I arrived breathless I had time to note the arrangement by species, not rigid indeed, but sufficiently striking to command attention. In the center were seen Hooded Warblers and a sprinkling of Chestnut-sides. On either side of these in turn were Black-throated Greens and Sycamores, about two hundred of each; while the wings proper were held by Bay-breasts and Black-polls in enormous numbers. * * * As the birds deployed to feed the specific lines were not quite obliterated.

Winter.—The following notes are contributed by Dr. Alexander F. Skutch: "The black-throated green warbler is an abundant winter resident in the Central American mountains, where it is well distributed on both the Caribbean and Pacific slopes. In Guatemala, it winters from 1,000 to about 8,500 feet above sea-level, but is not abundant at either of these extremes of altitude. Farther south, in Costa Rica, it prefers slightly higher elevations. Here I have not recorded it between 2,000 and 2,900 feet, although the greater part of my bird-watching in the country has been done in this altitudinal belt. From 2,900 feet, where it is rare as a winter resident, it ranges up to nearly 10,000 feet. At this elevation, I found it abundant on the Volcán Irazú in late November. Less sociable than the Townsend warbler, it does not form flocks, and except during the actual period of migration, is more often seen alone than in the company of others of its kind.

"As a rule the black-throated green warbler arrives late, and has rarely been recorded before mid-October. But on August 9, 1933, I found a lone male in full nuptial plumage with a mixed flock of small resident birds in an open oak wood on the Sierra de Tecpán in the Guatemalan highlands. He sang his dreamy, unsubstantial song as he foraged along with his newly found companions. I saw only one other of his kind—or possibly it was the same individual again—before early October, when the species began to arrive on the Sierra de Tecpán in numbers.

"Another early arrival appeared on September 28, 1938, in the yard of the cottage I occupied at Vara Blanca, at an altitude of 5,500 feet on the northern slope of the Cordillera Central of Costa Rica. During the following days, it came every afternoon to forage in the low cypress hedges that surrounded the dwelling. Possibly it was attracted to these because of associations with its native land, for these trimmed cypresses were the only coniferous trees in the vicinity—indeed, in Costa Rica, the warblers find no native conifers save two species of *Podocarpus*, a genus whose center of distribution is in the Southern Hemisphere rather than in the North. At times the newly arrived warbler descended to the bare ground in the flower garden, where it appeared to find something edible. On October 2 it was for the first time accompanied by a second of its kind. Throughout the winter months a black-throated green warbler continued to visit these cypress hedges.

"This is another migrant warbler that plucks the dainty white protein corpuscles from the velvety cushions at the bases of the long petioles of the Cecropia tree. In excessively humid highland regions, as at Vara Blanca, the wide, hollow internodes of these trees are much of the time flooded with water, and therefore uninhabitable by the Azteca ants which at lower elevations usually colonize them. In the absence of the ants, whose food these tiny morsels are, the birds find an abundance of them on the Cecropia trees. A number of small native birds, including finches, tanagers, warblers, honeycreepers and ovenbirds (Furnariidae), share them with the migratory warblers.

"By mid-March the males are in resplendent nuptial plumage. On April 27, 1933, I heard a male black-throated green warbler singing among the alder trees beside a rivulet on the Sierra de Tecpán. On April 4 and 5, 1938, a male sang repeatedly at the edge of the forest at Vara Blanca; and from this date until the disappearance of the species from the region on April 14 I often heard their song.

"There is a certain amount of evidence that with the increasing aridity of the dry season the black-throated green warblers withdraw early in the year from districts on the Pacific slope where they were present during the wetter closing months of the preceding year. Thus, on the Sierra de Tecpán I met none between December 7 and April 20, when the northward movement was in progress, and the birds seen were doubtless transients rather than winter residents. And in the higher parts of the Basin of El General in southern Costa Rica I have recorded the species only in October, November, and December, after which the nearly rainless season begins. But in the wetter climate of Vara Blanca, they were seen throughout February and March until their northward departure in April.

"The black-throated green warbler withdraws from Costa Rica about the middle of April, and by the end of the first week of May has vanished from Guatemala.

"Early dates of fall arrival in Central America are: Guatemala—passim (Griscom), October 15; Sierra de Tecpán, August 9, 1933; Finca Mocá, October 29, 1934. Honduras—Tela, October 26, 1930. Costa Rica—Vara Blanca, September 28, 1937; San José (Underwood), October 16; Basin of El General, October 22, 1936.

"Late dates of spring departure from Central America are: Costa Rica—Juan Viñas (Carriker), April 17; Vara Blanca, April 14, 1938. Guatemala—passim (Griscom), May 4; Sierra de Tecpán, May 6, 1933.

The following account of its winter haunts in El Salvador by Dickey and van Rossem (1938) is also interesting:

> All through the mountainous districts, both in the interior and coastwise, the black-throated green warbler is an extremely common winter visitant; in fact, it constitutes, at levels between 3,500 and 5,000 feet, fully 90 per cent of the nonresident warbler population. The numerous flocks of from a dozen to half a hundred individuals invariably formed the nuclei about which gathered smaller numbers of other insectivorous species resident and nonresident. The black-throated green warbler showed decided preference for the oak and pine association at the altitudes mentioned, although it was by no means confined to such environments.
>
> Many were seen in the coffee cover down to 3,000 feet on Mt. Cacaguatique and 2,300 feet at San Salvador. A few birds reach as high as 8,000 feet, at which level they were found in both pines and cloud forest on Los Esesmiles. * * * The average winter range of *virens* lies approximately 3,000 feet below that of *townsendi*, although strays and vagrants make the extremes of altitude nearly the same in both cases.

DISTRIBUTION

Range.—Eastern North America from southern Canada to Panamá.

Breeding range.—The black-throated green warbler breeds **north** to central western and northeastern Alberta (Grande Prairie, Peace River and Chipewyan); central Saskatchewan (Big River and Emma Lake); southern Manitoba (Brandon and Hillside Beach); southern

Ontario (Lac Seul, Rossport, Chapleau, and Lake Abitibi; casual or accidental at Moose Factory); central Quebec (Mistassini Post, Upper St. Maurice River, Godbout, Mingan, and Natashquan); and casually in southeastern Labrador (Battle Harbor). **East** to southeastern Quebec (Natashquan); southwestern Newfoundland (Spruce Brook and Tompkins); Nova Scotia (Sydney, Halifax, and Barrington); the coast of New England; Long Island (Miller's Place); northern New Jersey (Demarest and Dover); central Pennsylvania (Pottsville and Carlisle); central Maryland (Thurmont); central and southeastern Virginia (Charlottesville and Dismal Swamp); North Carolina (Lake Mattamuskeet); and central South Carolina (Charleston). **South** to South Carolina (Charleston); northern Georgia (Pinelog Mountains and Lookout Mountain); northeastern Alabama (Sand Mountain); southeastern Kentucky (Big Black Mountain and Jackson); central Michigan (Bay City and Mason County); northern Wisconsin (New London and Ladysmith); central Minnesota (Lake Minnetonka, Mille Lacs, and Cass Lake); southwestern Manitoba (Aweme); and southern Alberta (Brooks). **West** to western Alberta (Brooks, Glenevis, Sturgeon Lake, and Grande Prairie).

Winter range.—The black-throated green warbler is found in winter **north** to southern Texas (Arroya Colorado, Willacy County); and Yucatán (Tunkas and Chichén-Itzá). **East** to Yucatán (Chichén-Itzá); the coast of Quintana Roo; northeastern El Salvador (Mount Cacaguatique); eastern Costa Rica (Volcán Irazú); and central Panamá (Veragua); casual or accidental to northern Colombia (one record; Cincinnati, Santa Marta region). **South** to Panamá (Veragua and Volcán de Chiriquí). **West** to western Panamá (Volcán de Chiriquí); western Costa Rica (El General); western El Salvador (San Salvador); western Guatemala (Volcán de Agua and Dueñas); Oaxaca (Tehuantepec); western Morelos (Curnavaca); Puebla (Metlatoyuca); southern Tamaulipas (Altamira); probably eastern Nuevo León (Linares); and southern Texas (Santa Maria and Arroya Colorado).

The black-throated green warbler has apparently extended its winter range northward in recent years. Except for a single specimen taken at Brownsville in January 1911, it was not known to winter in Texas until 1933–34, when about 30 birds were seen. Since then it has increased and spread over most of Cameron County and to the southern border of Willacy County. One was recorded on Bull's Island, S. C., on January 8 and 9, 1940.

The species is also rare or casual in winter or migration in the West Indies: Cuba (Habana and Isle of Pines); Jamaica; Haiti (Île à Vache); Puerto Rico (Adjuntas); and the islands of St. Croix, Guadeloupe, and Dominica; also Watling Island, Bahamas.

The ranges as outlined apply to the entire species of which two geographic races are recognized. The northern black-throated green warbler (*D. v. virens*) is found in all the breeding range except the coastal region, from southeastern Virginia to South Carolina, which is occupied by Wayne's black-throated green warbler (*D. v. waynei*).

Migration.—Late dates of spring departure from the winter home are: Costa Rica—Juan Viñas, April 17. Guatemala—Tecpán, May 6. Tamaulipas—Xicoténcatl, May 11. Cuba—Habana, May 1.

Early dates of spring arrival are: Florida—Key West, March 3. Alabama—Eutaw, April 1. Georgia—Atlanta, March 26. South Carolina—Mount Pleasant, March 22. North Carolina—Raleigh, March 22. Virginia—Lawrenceville, April 3. West Virginia—French Creek, April 10. District of Columbia—Washington, April 18. Pennsylvania—Erie, April 19. New York—Rhinebeck, April 20. Massachusetts—Cambridge, April 19. New Hampshire—Tilton, April 26. Maine—Portland, April 26. New Brunswick—Scotch Lake, May 1. Nova Scotia—Wolfville, May 3. Quebec—Montreal, May 4. Louisiana—Avery Island, March 23. Mississippi—Oxford, March 10. Tennessee, Chattanooga, March 19. Kentucky—Eubanks, March 23. Arkansas—Delight, March 26. Missouri—Forsyth, April 8. Illinois—Murphysboro, April 11. Indiana—Bicknell, April 16. Ohio—Oberlin, April 13. Michigan—Vicksburg, April 13. Ontario—Guelph, April 20. Wisconsin—Milwaukee, April 19. Minnesota—Brainerd, April 25. Texas—Rockport, February 5. Kansas—Independence, April 1. North Dakota—Fargo, May 5. Manitoba—Aweme, April 30. Alberta—Edmonton, May 5.

Late dates of the spring departure of transients are: Florida—Pensacola, May 7. Alabama—Long Island, May 16. Georgia—Athens, May 14. South Carolina—Greenwood, May 17. North Carolina—Chapel Hill, May 24. Virginia—Norfolk, May 26. West Virginia—Fairmont, May 23. District of Columbia—Washington, June 10. Pennsylvania—Beaver, May 27. Louisiana—Lobdell, May 9. Mississippi—Horn Island, May 12. Tennessee—Knoxville, May 31. Arkansas—Delight, May 30. Missouri—St. Louis, May 22. Illinois—Chicago, June 3. Indiana—Notre Dame, June 2. Ohio—Toledo, June 5. Texas—Brownsville, May 15. Oklahoma—Tulsa, May 18. Kansas—Lawrence, May 16. Nebraska—Syracuse, May 27.

Early dates of fall departure are: Alberta—Glenevis, August 30. Manitoba—Brandon, September 24. North Dakota—Fargo, September 19 (bird banded). Nebraska—Stapleton, October 17. Oklahoma—Oklahoma City, November 2. Minnesota—Minneapolis, November 2. Wisconsin—Madison, November 1. Michigan—Detroit, November 1. Ontario—Ottawa, October 25. Ohio—Columbus, October 31. Illinois—Rantoul, October 31. Kentucky—Madisonville, October 24. Tennessee—Memphis, October 28. Mississippi—Gulfport, November 18. Louisiana—New Orleans, November 4. Newfoundland—Tompkins, October 4. Nova Scotia—Sable Island, October 7. New Brunswick—Saint John, October 12. Quebec—Quebec, October 3. Maine—Ellsworth, October 19. Vermont—Woodstock, October 19. Massachusetts—Harvard, November 2. New York—Scarsdale, October 26. Pennsylvania—McKeesport, October 25. District of Columbia—Washington, October 21. North Carolina—Weaverville, October 31. Georgia—Athens, November 1. Alabama—Fairhope, November 19. Florida—Sombrero Key, November 10 (two struck lighthouse, one killed).

Early dates of fall arrival are: North Dakota—Wilton, September 4. Kansas—Lake Quivira, September 6. Oklahoma—Tulsa, August 13. Texas—Cove, July 26. Ohio—Toledo, August 20. Indiana—Waterloo, August 14. Illinois—Chicago, August 15. Kentucky—Versailles, August 13. Missouri—Montier, August 25. Arkansas—Winslow, August 13. Tennessee—Memphis, August 7. Mississippi—Hernando, July 30. Louisiana—Breaux Bridge, August 12. Pennsylvania—Pittsburgh, August 20. District of Columbia—Washington, August 22. West Virginia—Bluefield, August 29.—Virginia—Charlottesville, September 3. North Carolina—Montezuma, August 27. Georgia—Atlanta, September 6. Florida—Pensacola, September 9. Cuba—Habana, September 30. Mexico—Cuernavaca, Morelos, September 14. Guatemala—Tecpán, August 9. Costa Rica—Vara Blanca, September 28.

Banding.—A few interesting records of banded birds are available. One banded at Hanover, N. H., on September 16, 1930, was found dead at Milledgeville, Ga., on February 25, 1935. Since the bird was an adult when banded it had lived at least five years and eight months. Another banded at Groton, Mass., on May 24, 1933, was "caught" at West Memphis, Ark., on October 22, 1933. A third bird, banded at Overbrook, Philadelphia, Pa., was killed by an Indian near Tetela, Oaxaca, Mexico, about April 1, 1936.

Casual records.—A specimen of the black-throated green warbler was collected on one of the Farallon Islands on May 29, 1911, and another seen on June 1. There are three records for Arizona: one collected in Ramsay Canyon, Huachuca Mountains, on May 9, 1895; one recorded seen in the same mountains in August 1932; and one collected May 30, 1933, in Toroweap Valley, Mohave County, on the brink of Grand Canyon. One was noted on the Teton River below Collins, Mont., on June 4, 1916. A specimen was collected at Barr Lake, Colo., May 20, 1909. In Monroe Canyon, Sioux County, Nebr. one was noted October 8, 1920. At Julianehaab, Greenland, a specimen was taken in 1853; and another at Sukkertoppen in the fall of

1933. There are three records for Bermuda: May 7, 1878; February 1927; and May 1, 1928. A specimen was secured on the island of Heligoland, Germany, on November 19, 1858.

Egg dates.—Massachusetts: 26 records, May 21 to July 11; 15 records, May 30 to June 10, indicating the height of the season.

New Brunswick: 13 records, June 13 to 28; 9 records, June 5 to 19.

New York: 19 records, May 30 to July 16; 10 records, June 2 to 11.

Nova Scotia: 13 records, June 7 to 28; 9 records, June 13 to 20 (Harris).

DENDROICA VIRENS WAYNEI (Bangs)

WAYNE'S BLACK-THROATED GREEN WARBLER

Contributed by Alexander Sprunt, Jr.

HABITS

It was a silent world, this great cypress swamp where I sought the nest of the Wayne's black-throated green warbler in the company of the man whose name it bears and who first made it known to science. A vast flooded expanse of trees and water—colorful, eerie, and mysterious—it was a realm of gray-green gloom. Huge trunks towered on all sides; long aisles of wine-dark mirror-smooth water stretched illimitably away among the buttressed columns. The grayness that predominated, from the furrowed knees and smoother trunks of the great trees to the shrouds of moss festooned from their branches, was relieved here and there by contrasting splotches of bright green overhead where occasional shafts of brilliant sunlight penetrated the canopy of feathery foliage.

Our dugout made no sound as it slid along. Only the slight splash of the paddle entering and leaving the water gave evidence of any means of propulsion. Now and again the silence was broken by the calls echoing down the flooded aisles—the clear whistle of the prothonotary warbler ringing sweetly, the full-voiced carol of the yellow-throated warbler, the strident call of the pileated woodpecker answered by the distant cry of a hunting red-shouldered hawk. Occasionally the deep, resonant "whoo-aw" of a barred owl reverberated solemnly among the cypresses, and once a sombre anhinga flapped ahead of the dugout to plunge cleanly into the still water in full career.

But above these evidences of swamp life, above the swish of breaking bass, the crashing splash of a disturbed alligator, the clamor of a startled heron or ibis, sounded one persistent call from the high branches—a song of seven notes, five on the same tone, one ascending, the last descending. It was this call that drew us on, the song of the bird whose nest we sought that morning, Wayne's warbler, the southern race of the black-throated green warbler.

To find the black-throated green warbler in a cypress swamp might seem strange indeed to one who knows the species in its spruce and balsam highlands, in the rhododendron and laurel thickets of the Blue Ridge, in the evergreens of the Adirondacks and Maine! Yet here it is, one of the characteristic avian dwellers of the warm swamplands of the South Carolina Low Country, arriving in the spring to nest amid the green cypress twigs, the drooping limbs of the magnolias, and the majestic spread of the live oak.

When Arthur T. Wayne of Mount Pleasant, S. C., discovered the first nesting of this race he was sure it was not a typical *Dendroica virens virens*, and on April 25, 1918 he sent a male to Outram Bangs of the Museum of Comparative Zoology in Cambridge, Mass. Later he sent him six other specimens. Upon comparing them with specimens of *D. v. virens*, Bangs (1918) described it as a different race, giving it the name of the discoverer, *waynei*. Extracts from his published material are illuminating. He states, for instance, that "this series proves to represent a form easily distinguishable from true *Dendroica virens* (Gmelin). I take great pleasure in naming it after the keen ornithologist and excellent observer and collector who discovered it, and who noticed its peculiarities even without sufficient material with which to compare it."

The subspecific differences are mainly a duller coloration, less yellowish, and of a paler shade, and the throat patch more restricted. Its principal variation from *virens* is its much smaller and more delicate bill. As Bangs points out, "measurements of a bill so small do not convey the same impression that an actual comparison of specimens does. The bill of the new form when compared to that of *D. v. virens*, appears not more than two-thirds as large." Certainly this is true. So marked is the difference that a specimen of *waynei* placed amid a score or more of *virens* can easily be picked out even at some distance.

The southern limit of the breeding range of *virens* appears to be the high mountains of Carolina and Georgia and northern Alabama, usually at elevations of more than 4,000 feet; *waynei* is confined to a coastal strip (in some cases less than 5 miles from the ocean) so that the intervening area between it and *virens* averages about 300 miles. In all that distance, no northern black-throated green warbler appears except in scattered and isolated instances. The migratory route of *waynei* is as yet imperfectly known, but since *virens* is so scarce along the lower Atlantic coast as to be virtually absent, and since it has never yet been secured or reported along the Carolina and Georgia or northern Florida coasts, it would seem that any specimen seen in those localities would be *waynei*.

Spring.—Wayne (1910) said of this bird in South Carolina: "This species arrives with great regularity [Charleston County] as the following dates will show, viz., March 26, 1890; March 27, 1900; March 27, 1912; March 23, 1916. It is not common until the middle of April and its passage through the coast region requires so long a time that one not acquainted with the migrations of birds might readily believe that it bred here . . . that this species should remain on the coast until June, and not breed is very surprising."

At that time he was, of course, unaware that the species contained two races, but, as Outram Bangs has pointed out (1918), these March arrival dates in coastal South Carolina occur when "true *D. virens* is still in winter quarters in Mexico and Central America." Thus, it will be seen that the migration times must vary considerably, and the arrival of the coastal race is in advance of the true species, indicating a different and less distant winter home, another phase to consider when comparing the two.

There is almost a complete dearth of additional information on arrival dates in other southern states. My records of South Carolina arrival dates in recent years do not vary much from Wayne's, and he has no earlier ones. I have but once encountered *waynei* in spring elsewhere than in South Carolina, this being a specimen observed in full song in Rhetta Lagoon, Cumberland Island, Ga., on April 15, 1932. However, that it was, in fact, a migrant is beyond all question for it is not present in its United States range in late fall and winter.

In his description of the race in 1918, Bangs stated that "it would seem not unlikely that the South Carolina form is resident and nonmigratory, and I hope Mr. Wayne will be able to prove whether or not this is so." This belief of Bangs' was carried into the A. O. U. Check-List (1931) which gives the range of this form as "resident in the coastal district of South Carolina." This is not the case; *waynei* does not remain in winter, and is therefore not resident but migratory, as I have previously pointed out (1932).

The migration of this race is as yet imperfectly known. While any coastal migrant black-throated green warbler would probably be referable to it, as *virens* appears to keep to the interior when travelling north, as a matter of fact there are almost no records of migratory occurrences. S. A. Grimes (MS.) tells me that he has never observed any black-throated green warbler in the area about Jacksonville, Fla., where he lives and where he is much afield, having had years of experience. Earle R. Greene (MS.) similarly states that his experience of over two years in the Okefenokee Swamp in southern Georgia failed to produce "a single individual." Strictly in line with his observations are those of Francis Harper (MS.) whose experience in the Okefenokee is even more extensive than

Greene's. He writes in response to my request, "I have never found the slightest trace of the bird there." This is strange, as the Okefenokee would seem to be typical habitat for the Wayne's Warbler, but it evidently does not occur there.

Courtship.—Nothing is known of the courtship behavior of this bird, owing to the difficulty of observation, the very restricted range of the bird, and the dearth of local observers.

Nesting.—Wayne was under the impression that he was the discoverer of the first known nest of this race, but search of the literature reveals that he was in error, though the first nests found were not recognized as those of *waynei*. Wayne secured the first eggs, and these still appear to be the only ones in existence, as all other breeding records deal with young birds. Authentic breeding information is exceedingly scanty, and since this is the case, all of the instances are mentioned herewith.

The first recorded breeding was in coastal North Carolina, and is mentioned by Pearson and the Brimleys (1919). They included it under the black-throated green warbler, as the species at that time had not been divided into two races. One nest was found at La Grange, Lenoir County, in June 1905 (Smithwick), and the other at Lake Ellis, Craven County, June 1910. Adults were seen feeding very young birds.

Continually impressed with the birds' presence in coastal South Carolina so late in spring, Wayne sought evidences of nesting and, on April 11, 1917, saw a female carrying nesting material in a large cypress swamp in Charleston County, but could not locate the nest. On the twenty-eighth of the same month he detected both a male and female in the same procedure but again failed to find the nest. His (1918) comment on this follows: "The brief account of this bird written in 'Birds of South Carolina' is, in the main, correct. Although I had never found it breeding when the book went to the press I was absolutely certain that it really bred on the coast." A year later, on April 28, 1918, he saw another female engaged in nest building, and again was unable to find the nest. Those who knew Wayne's untiring energy in such work can readily understand the extreme difficulty experienced in locating this elusive bird's home. It was on this last date that he secured the type specimen from which Bangs described the race. The following year finally brought success. Wayne (1919) states:

"On March 20, 1919, I visited the place where the type specimen was taken. * * * A few males were heard singing from the topmost branches of tall, gigantic, deciduous trees, and were also seen to fly into very tall pines." He again visited this spot on April eighteenth with Henry Moessner and the latter located a nest. It "was built in a live oak tree and on the end of a horizontal branch among twigs * * * absolutely concealed * * * about 38 feet above the ground." Wayne climbed a nearby tree and with Moessner's help from below, attempted to pull the oak limb toward him in order to reach the nest, when "sad to relate, without a moment's warning, the limb snapped off and the four fresh eggs that the nest contained were dashed in fragments on the ground."

The nest itself was preserved, and Wayne describes it as "small and compact, measuring 1¾ inches in height and 1½ inches in depth. It is constructed of strips of fine bark and weed stems, over which is wound externally the black substance that is invariably present in the lining of the nests of Bachman's Warbler (*Vermivora bachmanii*). The interior * * * is chiefly composed of a beautiful ochraceous buff substance, doubtless from the unfolding leaves of some fern, and a few feathers."

On the twenty-eighth, ten days after this nest was found, Wayne returned to the swamp with the Misses Louise Ford and Marion Pellew and found "a very young bird just from the nest and unable to fly more than a few feet, being fed by the male parent, which shows that the birds breed irregularly."

The party proceeded to another part of the swamp where a female was seen to enter a large magnolia. "Miss Ford * * * saw the female go to her nest * * * built near the extremity of a long drooping magnolia limb, but on the horizontal portion of it and about 25 feet above the ground." This nest held four heavily incubated eggs, these being the first ones actually taken. This nest had a quantity of caterpillar silk binding the fibres of Spanish and hypnum moss outside, and was "lavishly lined with the beautiful ochraceous buff substance from young fern leaves, as in the first nest."

Edward S. Dingle (MS.) writes that "on the morning of April 25, 1923, a Wayne's warbler was observed building in a cypress tree; the bird collected material from the ground and also from the trunk of a large cypress nearby. The male was not seen." On the third of May following, I accompanied Wayne and Dingle to the site; there Dingle located the nest, climbed the tree, and secured it, with four eggs. This nest was 62 feet from the ground and 5 feet out from the trunk. This is the third, and last nest from South Carolina with eggs, on which data are extant. All, with the exception of the first, were in Wayne's collection at his death, and are now in the Charleston (S. C.) Museum. The sites in each case, were found by Wayne, but the nests were actually located by Moessner, Dingle, and Miss Ford.

Commenting on these discoveries, Wayne (1919) states: "I have known this bird ever since May 4, 1885 when I took a male in Caw-caw Swamp, Colleton County, S. C., while on a collecting trip with my friend, the late William Brewster. I gave the bird to him in the flesh, and in his collection it still remains. The nest and eggs have remained unknown until brought to light by this season's research."

Russell Richardson (1926) reported black-throated green warblers in the Dismal Swamp, on the North Carolina side, in June. No evidence of nesting was found by him, and he did not, apparently, realize that the birds he saw were *waynei.* In 1932 Drs. W. R. McIlwaine and J. J. Murray visited Dismal Swamp on May 23–26, and "found Wayne's warblers rather common." From Murray (1932) we find that they "heard two singing males on May 23rd as we came down the Washington Ditch to the Lake; two males singing on the 24th near the entrance to the Feeder Ditch * * * and six males on the 26th." They also found two family parties of adults feeding small birds on the 24th. One of these parties was near the mouth of the Feeder Ditch; the other a half mile up the Jericho Ditch from the Lake (Drummond). * * * The young birds were out of the nest and could fly well. They looked like big bumble-bees buzzing across from one tree to another; staying rather high up. The adults ranged low in gathering food, both male and female feeding the young birds."

Eggs.—The eggs of *waynei* are similar to those of *virens.* Wayne has described them (1919) as "of a white or whitish color speckled and spotted in the form of a wreath around the larger end with brownish red and lilac." The sets previously described are the only ones of which the writer is aware, and may be the only ones in collections. Whether any have ever been secured outside of South Carolina is doubtful. Measurements of Wayne's two sets average 16.79 by 12.25 and 15.12 by 12.03 mm., a trifle under the average for eggs of *virens.* The breeding records for the Dismal Swamp (Virginia) and two localities in North Carolina, concern young birds only.

Plumages.—Data available are not sufficient for a detailed description of the plumages but they are probably the same as those of *virens.*

Food.—No positive information on the food of *waynei* exists, as far as I can ascertain, except that in July 1939, G. H. Jensen examined the stomach contents of a single specimen secured by Howell and Burleigh at Murrells Inlet, S. C., June 5, 1932. It was full and contained 100 percent animal matter, consisting of 3 Lepidoptera larvae, 98 percent; 1 *Formica* sp., 2 percent. That the race is insectivorus goes without saying, but more than that remains to be worked out. Howell (1932) cites Barrows as saying that *virens* consumes plant lice, span-worms, and leaf-rollers together with berries of poison ivy. Probably *waynei* indulges similar tastes.

Behavior.—Wayne's warbler is essentially a high-ranging bird. It spends much of its time amid the topmost branches of cypress, magnolia, gum, and other swamp trees, rarely descending to even mid-sections of this characteristic growth while feeding. Highly restless and exceedingly active in movements, it is constantly on the go and, as a consequence, is rather difficult to see and study satisfactorily, the oft-repeated song being the best indication of its whereabouts. As might be supposed, the female is even more elusive, and flits about like some swamp wraith, silent and mysterious. The failure of as keen an observer as Wayne to locate the nests of building females gives an idea of its secretiveness.

In these respects it differs materially from *virens*, at least in my experience with that race, which is frequency found at rather low elevations. Doubtless the type of growth is responsible, for *virens* is a spruce-balsam-hemlock dweller, and these evergreens are dense trees with branches often beginning only a few feet from the ground, so that it can be seen and watched rather easily.

While several authors have referred to *virens* as a tame bird, the same cannot be said for *waynei.* In years of experience with the latter, I have always found it shy and retiring. Singing freely enough if unaware of observation, it often ceases when it detects an intruder, and since the song is one of the surest means of locating it, great care has to be taken in moving about, particularly near the nest.

The nest is impossible to find without watching the female, for it is more often than not completely invisible from the ground. *D. v. waynei* is found in the same habitat with yellow-throated and parula warblers, but, unlike them, never utilizes the hanging clumps of Spanish moss (*Tillandsia*) in which they invariably nest. I have climbed a tall cypress and collected a nest and eggs of *D. d. dominica* while *waynei* was singing in the near vicinity. The preference of *waynei* for heavy, old-growth swamp forests is so marked that if this timber is cut out, the bird disappears from the area completely, even though other growth is left standing. In the South Carolina Low Country, this characteristic is shared by both Bachman's and Swainson's warblers, both of which nest in heavy-swamps.

Voice.—Though it was the cuckoo which Bryant characterized as "a wandering voice," he might well have written the words with respect to this tiny warbler for the bird is heard far more readily than it is seen. As a songster it is all but indefatigable. Perhaps this is because the depths of the cypress swamps and the old "backwaters" are cooler than the surrounding highlands, but no matter how warm the day, or close the atmosphere, the constantly reiterated, seven-note song resounds through the air most of the day. The ornithologists I have guided to the haunts of *waynei* all agree that the song is very close to that of *virens.* Perhaps it is a shade more deliberate and studied, as might be expected of a southerner! However, to all intents and purposes, it is the same song. I am inclined to describe it as slower and more pronounced, but after all the difference is minor.

Arthur H. Howell (1932) describes the song of *virens* as "a drowsy, drawled ditty of four or five notes, *wee-wee-wee-su-see*, the next to last note on a lower pitch and the final one distinctly higher." This portrays quite well the song of *waynei*, except for the number of notes, which are much oftener seven than less, the first five being exactly alike, the sixth descending, and the seventh ascending.

Frank M. Chapman (1907), quoting Gerald Thayer, says of *virens* that "most of the individuals in a region sing nearly alike . . . but about one in forty does queer tricks with its voice. Among the commonest of these tricks is the introduction into all parts of the song of a pronounced quaver or tremulo. . . . The song is sometimes disguised almost past recognition." He states further that the "deliberate song of five (sometimes six or eight) notes, is the one usually described in books."

I have never noted any "quaver or tremulo" in the song. It may occur, but in the scores of times I have heard the song it has not taken place. Nor can I recall any song of eight notes. Occasionally, *waynei* will utter only five notes, but this is the marked exception and not the rule. Certainly, individuals in a given region sing exactly alike, and indeed, all the specimens I ever heard sounded alike, except for the occasional slight variation in number of notes.

Fall.—The length of stay of *waynei* in its summer range has not yet been determined with certainty. Few departure dates have been recorded, but in all probability the bird is a rather early migrant. Occurrence of the song decreases markedly after the nesting season, making the birds' movements much more difficult to trace. It will be recalled that young were noted flying on May twenty-fourth, in the Dismal Swamp of Virginia. South Carolina birds were seen to fly "a few feet" on April twenty-eighth, almost a month earlier. The North Carolina records show that young were noted "in June", probably early in the month. That multiple broods are raised is also something of an open question, though it seems that in South Carolina two are raised. Henry H. Kopman (1904) states that on July 30, 1897, he took one at Beauvoir, Miss., on the Gulf coast, and later comments (1905) that "Professor Cooke [W. W.] is inclined to think" that the Beauvoir bird was a stray. Probably it was a stray, and in view of what we know today, the chances are that the bird was a specimen of *waynei*. Many of the birds of course linger much later than that; on September 29, 1935, Earle R. Greene [MS.] noted one at Lake Mattamuskeet, N. C. This is doubtless a rather late date and may be taken as about the limit of its stay along the Atlantic coast.

Enough remains to be learned about this most interesting race to keep students busy. The highly attractive type of habitat, the marked isolation of nesting pairs even in a restricted range, the active character and handsome appearance of the bird itself, all these combine to render Wayne's warbler distinctive and appealing.

DENDROICA CHRYSOPARIA Sclater and Salvin

GOLDEN-CHEEKED WARBLER

HABITS

This elegant warbler is confined in the breeding season to a very narrow range in south-central Texas, the timbered parts of the "Edwards Plateau" region. It has been reported as breeding in Bandera, Bexar, Comal, Concho, Kendall, Kerr, and Tom Green Counties, and rarely north to Bosque and McLennan Counties. It winters in the highlands of southern Mexico and Guatemala.

The golden-cheeked warbler was entirely unknown to early American ornithologists. William Brewster (1879) gives the following brief account of its early history: "The original specimens were procured by Mr. Salvin in Vera Paz, Guatemala. Since that time, with the exception of a male obtained by Mr. Dresser, near San Antonio, Texas, about 1864, no additional ones have apparently been taken. The specimen mentioned by Mr. Purdie was taken by George H. Ragsdale in Bosque County, Texas, April, 1878." The bird is now well known in the limited region outlined above, and many specimens of the birds, their nests, and their eggs have found their way into collections.

The first comprehensive account of its habits was given to Dr. Chapman (1907) by H. P. Attwater, of San Antonio, Tex. He says of its summer haunts in the counties named above:

> The Goldencheek is not a bird of the forest, being seldom met with in the tall timbered areas in the wilder valleys along the rivers, or in the tall trees which fringe the streams in the cañons; but its favorite haunts are among the smaller growth of trees, on the rough wooded hillsides, and which covers the slopes and "points" leading up from the cañons, and the boulder strewn ridges or "divides" which separate the heads of the creeks. The trees which compose this growth consist chiefly of mountain cedar (juniper), Spanish or mountain oak, black oak, and live oak on the higher ground, and live oak and Spanish oak clumps or thickets on the lower flats among the foothills, interspersed in some localities with dwarf walnut, pecan and hackberry. All these trees grow on an average from 10 to 20 feet high, the cedar often forming almost impenetrable "brakes". Whatever space remains among the oaks and cedars is generally covered with shin oak brush, which is a characteristic feature of the region. The cedar or juniper appears to possess some peculiar attraction for this bird for they are seldom found at any great distance from cedar localities, and they seem to divide the greater part of their time between the cedars and Spanish oaks, searching for insects, with occasional visits to other oaks, walnuts, etc., but seldom descend-

ing as low as the shin oak brush, which averages four to five feet. It is quite probable that future observations will show, that some favorite insect food which comprises a portion of their "bill of fare," is found among the cedar foliage.

Spring.—The golden-cheeked warblers arrive in central Texas about the middle of March, sometimes a little earlier or later. The adult males precede the young males and females by about 5 days. Mr. Attwater (Chapman, 1907) says: "The song of the male is the first unmistakable notification of its arrival and within a few days it is quite common and the females are also observed. In the localities described the Golden-cheeked Warbler is by no means a rare bird, and it is by far the most abundant of the few Warblers, which breed in the same region."

Nesting.—W. H. Werner was apparently the first to find the nest of the golden-cheeked warbler, in Comal County, Tex., in 1878, about which he wrote to Mr. Brewster (1879): "The four nests that I have found were similar in construction, and were built in forks of perpendicular limbs of the *Juniperus virginiana*, from ten to eighteen feet from the ground. The outside is composed of the inner bark of the above-mentioned tree, interspersed with spider-webs, well fastened to the limb, and in color resembling the bark of the tree on which it is built, so that from a little distance it is difficult to detect the nest." Two of these nests were examined by Mr. Brewster both so much alike that the following description of one will suffice:

> It is placed in a nearly upright fork of a red cedar, between two stout branches to which it is firmly attached. Although a large, deep structure, it by no means belongs to either the bulky, or loosely woven class of bird domiciles, but is, on the contrary, very closely and compactly felted. In general character and appearance it closely resembles the average nest of the Black-throated Green Warbler (*Dendroica virens*). It is, however, of nearly double the size, in fact, larger than any Wood Warbler's nest (excepting perhaps that of *D. coronata*) with which I am acquainted. It measures as follows: external diameter, 3.50; external depth, 3.45; internal diameter, 1.60; internal depth, 2.00. The exterior is mainly composed of strips of cedar bark, with a slight admixture of fine grass-stems, rootlets, and hemp-like fibres, the whole being kept in place by an occasional wrapping of spider-webs. The interior is beautifully lined with the hair of different quadrupeds and numerous feathers; among the latter, several conspicuous scarlet ones from the Cardinal Grosbeak. The outer surface of the whole presents a grayish, inconspicuous appearance, and from the nature of the component materials is well calculated to escape observation. Indeed, it must depend for concealment upon this protective coloring, as it is in no way sheltered by any surrounding foliage.

Attwater (Chapman, 1907) says:

> Of over fifty nests of this bird which I have examined, most of them were securely placed in perpendicular forks of the main limbs of cedar trees, about two-thirds up in the tree; average fifteen feet from the ground. My highest record is twenty-one feet, and lowest six feet. I have also found them in similar

positions in small black oak, mountain oak, walnut and pecan trees. * * * The favorite nesting haunts are isolated patches or clumps of scrubby cedars, with scant foliage, on the summits of the scarped cañon slopes, and in the thick cedar "brakes." In cedar the older growth of trees is always selected, and no attempt at concealment is made. I have never found a nest in a young thrifty cedar with *thick* foliage.

The male is always to be heard singing in the vicinity of the nest, and the old nesting localities, and occasionally the same tree is selected apparently and returned to one year after another.

Nearly all the nests reported by others were in cedars and were similar in construction to those described. There are five nests of the golden-cheeked warbler in the Thayer collection in Cambridge, of which only one was in a cedar; two were in Spanish or mountain oaks and two in live oaks; four of these had more or less admixture of lichens, mosses, bits of dry leaves, and plant down in the bases, and feathers of quail, cardinal and other birds in the linings. The smallest nest in the series measures externally 2½ inches in diameter and 2 inches in height; it is very neatly and firmly woven.

Plumages.—Ridgway (1902) describes the juvenal plumage of the golden-cheeked warbler as follows: "Pileum, hindneck, back, scapulars, rump, and upper tail-coverts plain grayish brown or brownish gray; sides of head, chin, throat, chest, and sides pale brownish gray; rest of under part white, the breast very indistinctly streaked with pale gray; wings and tail essentially as in adults, but middle coverts with a mesial wedge-shaped mark of dusky."

Apparently there is a partial postjuvenal molt early in the summer, which is similar to that of other wood warblers. This produces the first winter plumages, in which the sexes are recognizable and much like the respective adults at that season. In the young male the upper parts are streaked with olive-green and black, the upper tail coverts are margined with olive-green and gray, and the white tips of the median wing coverts have narrow, black shaft streaks instead of the dusky wedges seen in the juvenal coverts. Ridgway (1902) says of the young female: "Similar to the adult female but pileum, hindneck, back, scapulars, rump, and upper tail-coverts plain olive-green, or with very indistinct narrow streaks of dusky on pileum and back; throat and chest pale grayish (the feathers dusky beneath surface), the former tinged with yellow anteriorly; sides and flanks indistinctly streaked with dusky."

I have seen no specimens showing a prenuptial molt, which is probably finished before the birds arrive in Texas. The first and subsequent nuptial plumages may be largely produced by wear, as the fall and winter plumages are much like those of spring birds, but are concealed by the tips and margins of the feathers. However, it would be strange if there were no prenuptial molt, especially in young birds.

Young birds in first nuptial plumage can be recognized by the worn and faded wings and tail.

Eggs.—Four eggs make up the regular set for the golden-cheeked warbler, although sometimes only three and very rarely five are found. They are ovate to short ovate and have only a very slight lustre. They are white or creamy white, finely speckled and spotted with "bay," "auburn," or "chestnut," and occasionally "argus brown," intermingled with spots of "vinaceous drab," "brownish drab," or "light mouse gray." They are generally finely marked, but sometimes eggs will have spots which are large enough to be called blotches, or even a few small scrawls of very dark brown. The markings are concentrated at the large end, where frequently a fine wreath is formed, or the speckles may be so dense as to almost obscure the ground; occasionally the markings are scattered over the entire egg. The measurements of 50 eggs average 17.7 by 13.1 millimeters; the eggs showing the four extremes measure 18.9 by 13.0, 17.8 by 13.7, and 15.6 by 12.4 millimeters (Harris).

Young.—We have no information on incubation or on the care and feeding of the nestlings. Attwater (Chapman, 1907) has this to say:

> The young birds out of the nest, which are being fed by the parents late in April and in May, are from early nests which have escaped destruction by "northers" on account of their sheltered positions and situations, and it is possible that then another nest is built and a second brood reared. * * * During June the family groups wander about together, chiefly in the cañons and along the lower hillsides, keeping together till the young are old enough to take care of themselves. While being fed by the parents the "twittering" of the young birds is continually heard, with the cautions "tick, tick" alarm notes of the female when enemies approach. Early in July they begin to scatter, as most of the young birds are then able to shift for themselves.

Food.—Very little has been mentioned regarding the food of this wood warbler beyond the fact that it seems to be mainly, if not wholly, insectivorous. Mr. Attwater (1892) says: "Upon examining the stomachs of a number of young birds which were being fed, I found they all contained (with other insects) a number of small black lice (*Aphis* sp.) which I watched the old birds collecting from the green cedar limbs."

Behavior.—Mr. Attwater wrote to Dr. Chapman (1907):

> Like most of the same sex of other Warblers, the female of this species is very shy, and seldom noticed except when an intruder disturbs the nest or when feeding the young after leaving it, but the male Golden-cheeked Warbler is by no means a shy bird. He keeps continually flying from tree to tree in search of insects, and on fine days uttering his song at short intervals from early dawn until after sundown, and before nest building begins shows little alarm upon being approached. I have stood under a tree a number of times within five or six feet of a wandering male Golden-cheek, which appeared as pleased and

interested in watching *me* as I was in observing him. Seemingly he was desirous of assisting me to describe his song in my note-book, by very obligingly repeating it frequently for my special benefit.

Mr. Werner told Mr. Brewster (1879) that "their habits were similar to those of *D. virens;* they were very active, always on the alert for insects, examining almost every limb, and now and then darting after them while on the wing."

Voice.—The song evidently bears a resemblance to that of the black-throated green warbler in quality. Mr. Werner wrote it *tsrr weasy-weasy tweah*, and referred to the notes as soft. Mr. Attwater wrote to Dr. Chapman (1907) : "It would be difficult to describe the Golden-cheek's song with any real satisfaction. It varies somewhat, being uttered much more rapidly by some individuals than by others. At a distance only the louder parts are heard, so that it sounds quite different than when heard at close quarters. The hurried song might be given as *tweah*, *tweak*, *twee-sy*, with some individuals introducing an extra note or two, and the slower or more deliberate style *twee-ah*, *eseah*, *eachy*. After the young leave the nests the males gradually stop singing, and at this period sometimes only use a part of the regular song."

George Finlay Simmons (1925) describes the song as "ventriloquistic, elusive, seeming to come from here, there, everywhere; *ter-wih-zeee-e-e-e*, *chy*, the first, second, and fourth notes short and soft, the third longest, most distinct, and with the shrill buzzing *z-z-z-z* quality of the Black-throated Green Warbler's song. * * * Sung by male from conspicuous perch atop a small tree near nest and hidden female; heard commonly in spring in the Golden-cheek habitat; males gradually stop singing when young have left nest. Call, chirping in migration; female, a soft, scolding *check*, *check*, *check* or *tick*, *tick*, uttered slowly, a note at a time."

Enemies.—According to Dr. Friedmann (1929), the golden-cheeked warbler is "apparently a rather rare victim of the Dwarf Cowbird." He mentions only three authentic cases.

Field marks.—The golden-cheeked warbler might at first glance be mistaken for a black-throated green warbler, but the upper parts in the adult male are deep black from crown to tail, instead of olive-green, and the under parts, except for the black throat, are white and not tinged with yellow. The female differs from the eastern bird in the same way.

Fall.—Golden-cheeked warblers do not remain on their breeding grounds very long and leave for their winter resorts in Mexico and Central America before the end of summer. Mr. Attwater told Dr. Chapman (1907) that "early in July they begin to scatter, as most of the young birds are then able to shift for themselves. By the middle of July most of the old males have stopped singing, and by the end of July old and young have disappeared from their usual haunts. I have noticed a few stragglers during the first two weeks in August, and all probably leave before September first."

DISTRIBUTION

Range.—Texas to Nicaragua.

Breeding range.—During the breeding season the golden-cheeked warbler is confined to a few counties in south central Texas: **North** to Kerr (Ingram and Kerrville) and Travis (Austin) Counties; **south** to Bexar (San Antonio) and Medina (Castroville) Counties; and **west** to Real County (West Frio Canyon). It is probably not so narrowly confined as the definite records indicate. It has been recorded in summer, but with no indication of breeding, at Waco, Hunt, and Commerce.

Winter range.—Little is known of the golden-cheeked warbler in winter. At that season it has been found at Teziutlán, western Veracruz; Tactic, central Guatemala; and Matagalpa, central northern Nicaragua. On November 23, 1939, and January 8, 1940, a male was observed on the island of St. Croix, Virgin Islands. It has been observed in Tamaulipas and Nuevo León in March, probably on migration.

Migration.—The golden-cheeked warbler is an early migrant both in spring and fall. It has arrived at Kerrville, Tex., as early as March 5, and the majority of the birds have left by the middle of July; latest, Ingram, August 18.

Egg dates.—Texas: 29 records, April 1 to June 27; 10 records, April 11 to 24; 10 records, May 18 to 28 (Harris).

DENDROICA OCCIDENTALIS (Townsend)

HERMIT WARBLER

PLATE 39

HABITS

This well-marked wood warbler lives in summer in the high coniferous forests of the west, from British Columbia southward to the southern Sierra Nevadas in California, and spends the winter in Mexico and Central America. This is another of those species discovered by J. K. Townsend along the Columbia River, of which he wrote to Audubon (1841): "I shot this pair of birds near Fort Vancouver, on the 28th of May, 1835. I found them flitting among the pine trees in the depth of a forest. They were actively engaged in searching for insects, and were frequently seen hanging from the twigs like Titmice. Their note was uttered at distant intervals, and resembled very much that of the Black-throated Blue Warbler, *Sylvia canadensis*."

In northwestern Washington the hermit warbler is not common and is decidedly local in its summer haunts, being regularly found in certain favored regions and entirely absent in other somewhat similar localities. It is partial to a certain type of coniferous forest, and when one learns to recognize the proper environment he is quite likely to find it. D. E. Drown and S. F. Rathbun showed me some typical haunts of this warbler near Tacoma, where J. H. Bowles has found it nesting. This is level land covered with a more or less open growth of firs and cedars, the largest trees, giant Douglas firs, are somewhat scattered and tower above the rest of the forest, some reaching a height of 200 feet or more. As the warblers spend most of their time in the tops of these great trees and are very active, it is difficult to identify them even with a good glass, and still more difficult to follow them to their nests.

Chester Barlow (1901) says that in the central Sierra Nevada, in California, "the hermit warbler is pre-eminently a frequenter of the conifers, although it feeds in the bushes and black oaks in common with other species." In the Yosemite region, according to Grinnell and Storer (1924), "the Hermit Warbler is a bird of the coniferous forests at middle altitudes. Pines and firs afford it suitable forage range and safe nesting sites. The birds keep fairly well up in the trees, most often at 20 to 50 feet from the ground. The Hermit may thus be found in close association with the Audubon Warbler, although the latter ranges to a much greater altitude in the mountains."

Spring.—Dr. Chapman (1907), outlining the migration of the hermit warbler, says that it "enters the United States in April being reported from Oracle, Arizona, April 12, 1899, and the Huachuca Mountains, Arizona, April 9, 1902. Records of the earliest birds seen in California are Campo, April 27, 1877, and Julian, April 25, 1884. A Hermit Warbler was noted at Burrard Inlet, British Columbia, April 20, 1885." Swarth (1904) says that the first arrivals in the Huachucas "appeared in the very highest parts of the mountains, but a little later they could be found in all parts of the range, and on April 17, 1902, I saw a few in some willows near the San Pedro River." Mrs. Amelia S. Allen's notes from the San Francisco Bay region, give dates of arrival from April 24 to May 10. In northwestern Washington, according to Bowles (1906), "the hermits make their first appearance early in May and the fact is only to be known thru their notes; for they frequent the tops of the giant firs which cover large sections of our flat prairie country."

Nesting.—The first undoubted nests of the hermit warbler were found by C. A. Allen in Blue Cañon, California, two in 1886 and one about eight years previously, about which he wrote to William Brewster (1887): "All three nests were similarly placed;—in 'pitch pines,' from twenty-five to forty feet above the ground, on thick, scraggy limbs, where they were so well concealed that it would have been impossible to find them except by watching the birds, as was done in each instance." One of these nests held two eggs on June 4, but they were destroyed before they could be collected; the other two nests contained three young each. One of the nests with three young was sent to Brewster, who writes:

> The nest with young, taken June 7, 1886, is now before me. It is composed of the fibrous stalks of herbaceous plants, fine dead twigs, lichens (*Evernia vulpina*), and a little cotton twine, and is lined with soft inner bark of some coniferous tree and fine long hairs, apparently from the tail of a squirrel. The bright, yellow *Evernia*, sprinkled rather plentifully about the rim, gives a touch of color to the otherwise cold, gray tone of the exterior and contrasts agreeably with the warm, reddish-brown lining. Although the materials are coarse and wadded, rather than woven, together, the general effect of this nest is neat and tasteful. It does not resemble any other Warbler's nest that I have seen, but rather recalls the nest of some Fringilline bird, being perhaps most like that of the Lark Finch. It measures externally 4.50 inches in width by 2 inches in depth. The cavity is 1.25 inches deep by 2.50 inches wide at the top. The walls at the rim average nearly an inch in thickness.

Chester Barlow (1901), who has had considerable experience with the nesting of the hermit warbler in the central Sierra Nevada, refers to the records up to that time as follows:

> On June 10, 1896, Mr. R. H. Beck collected a nest and four eggs from a limb of a yellow pine 40 feet up, near the American River at 3,500 feet altitude. The nest was reached by means of a ladder carried a long distance up the mountain. (See *Nidologist*, IV, p. 79). On June 14, 1898, I had the good fortune to discover a nest opposite the station at Fyffe, it being built at the end of a small limb of a yellow pine 45 feet up. The nest was located by searching at random and contained four eggs about one-fourth incubated. This nest was described at length in *The Auk* (XVI, pp. 156–161.) * * * While walking through the timber at Fyffe on June 8, 1899, Mr. H. W. Carriger came upon a nest of this species but 2½ feet up in a cedar sapling. It contained four eggs, advanced in incubation. (See CONDOR I, pp. 59–60). A nest containing young about four days old found by Mr. Price's assistant at Fyffe on June 11, 1897, was placed twelve feet up near the top of a small cedar, next to the trunk and well concealed. Thus it is probable that Fyffe has afforded more nesting records of this species than has any other part of the state.

Of the nest described in *The Auk*, Barlow (1899) says:

> The nest was 45 feet from the ground in a yellow pine, built four feet from the trunk of the tree on an upcurved limb 18 inches from the end. * * * The nest is not fastened to the limb, resting merely upon the limb and pine needles and is wider at the bottom than at the top, its base measuring four inches one way and three inches the other. It is very prettily constructed, the bottom layer

being of light grayish weed stems, bleached pine needles and other light materials held securely together by cobwebs and wooly substances. The nest cavity is lined with strips of red cedar bark (*Libocedrus*) and the ends, instead of being woven smoothly, project out of the nest. The inner lining is of a fine brownish fiber resembling shreds of soap-root. The composition of the nest gives it a very pretty effect.

J. H. Bowles (1906) found a nest in northwestern Washington on June 11, 1905, "in a grove of young hundred-foot firs near a small swamp." The female sat so close that he was obliged to lift her from the nest with his hand—

> and she then flew only a few feet where she remained chipping and spreading her wings and tail. * * * The nest was placed twenty feet from the ground in a young fir, and was securely saddled on a good sized limb at a distance of six feet from the trunk of the tree. It is a compact structure composed externally of small dead fir twigs, various kinds of dry moss, and down from the cotton-wood flowers, showing a strong outward resemblance to nests of *D. auduboni*. But here the likeness between the two is at an end; for the lining consists of fine dried grasses, and horsehair, with only a single feather from the wing of a western bluebird. The measurements are, externally, four inches in diameter and two and three-quarters inches deep; internally, two inches in diameter by one and a quarter inches deep."

A nest in the Thayer collection in Cambridge was collected by O. W. Howard "70 feet above ground, near the end of a limb of a yellow pine, in a bunch of needles," in Tulare County, Calif. Gordon W. Gullion tells me of an Oregon nest that was "about 125 feet above the ground."

Eggs.—The hermit warbler lays 3, 4, or 5 eggs to a set; 5 are apparently not rare. Bowles (1906) says of his 5 eggs: "They have a rather dull white ground with the slightest suggestion of flesh color, heavily blotched and spotted with varying shades of red, brown and lavender. * * * I think they may be considered the handsomest of all the warblers' eggs." The 4 eggs in the Thayer collection in Cambridge are ovate, with a very slight lustre. They are creamy white, finely speckled and spotted with "chestnut" and "auburn," with intermingling spots of "light brownish drab." The markings are concentrated at the large end, forming a broad, loose wreath. The measurements of 50 eggs average 17.0 by 13.1 millimeters; the eggs showing the four extremes measure **18.0** by 13.4, 17.0 by **13.7**, **15.2** by 12.7, and 16.3 by **11.8** millimeters (Harris).

Young.—We have no information on the incubation of the eggs, nor on the care and development of the young.

Plumages.—I have examined the nestlings sent to Brewster by C. A. Allen; they are about two-thirds fledged on the body and wings; the heads still show the long natal down, "hair brown" in color; the feathers of the back are "olive brown"; the wings are "clove brown," with two narrow, white wing bars, faintly tinged with pale yellow; the breasts and sides are pale "hair brown" to "light grayish olive"; and the rest of the under parts are yellowish white. A young bird in fresh plumage, collected July 1, is probably in full juvenal plumage; its body plumage is similar to that of the nestlings, but there is some yellow on the forehead and throat, and the sides of the head and neck are decidedly yellow; however, this may be a bird that has assumed its first winter plumage at an unusually early date.

In first winter plumage, young birds of both sexes are much like the adult female at that season, mainly grayish olive-green above, with black streaks concealed or absent; forehead, sides of the head, and chin pale yellow; and the rest of the under parts buffy white, the sides browner. The broad, white tips of the lesser wing coverts have a black shaft streak or wedge, apparently characteristic of this plumage. There is probably a prenuptial molt involving much of the head and body plumage and the wing coverts, but the dull juvenal wings are retained until the next molt.

The complete postnuptial molt occurs in July and August. The fall plumages of both sexes are like the spring plumages, but the clear blacks and yellows are largely concealed by olive above and by buffy below.

Food.—The only item I can find on the food of the hermit warbler is the following short statement by Bowles (1906): "Their food consists of small spiders, caterpillars, tiny beetles, and flying insects which they dart out and capture in a manner worthy of that peer of flycatchers the Audubon warbler."

Behavior.—The most marked trait of the hermit warbler is its fondness for the tree tops, spending much of its time in the tops of the tallest firs, often 200 feet or more above the ground, where it is very active and not easy to follow. But it builds its nest at lower levels, and often comes down to forage in the lower branches, in smaller trees and even in the underbrush, where it is not particularly shy and can be easily approached. It is a close sitter while incubating; Bowles had to lift one off its nest.

A hermit warbler watched by Miss Margaret W. Wythe, in Yosemite Valley, "was foraging in the upper parts of the trees and never came to the lower branches. Starting from near the trunk of a pine it would work out to the tip of one branch before going to another. Its demeanor while foraging was much more deliberate than that of any of the other warblers" (Grinnell and Storer, 1924).

Voice.—Rathbun (MS.) writes: "The song is quite strong, can be heard a considerable distance, and when given in full consists of five or six notes. The first note, rather faint, rises and then falls, with a slight accent at its close; if one is quite close to the singer, the note has a light lisping sound. This note is followed by another, similar but stronger and more prolonged. Then come three or four short, clear notes quickly given, the song ending with a prolonged rising one that closes sharply. Our interpretation of the song would be *zweeo-zweeo-zwee-zwee-zwee-zweeck*. Whenever an additional note is given, it is of the intermediate kind. One or two of these notes are, to us, suggestive of some heard in the song of Townsend's warbler. The song is quite rapidly sung in an energetic way, being very distinctive and is pleasing. It resembles the song of no other warbler in the region."

Bowles (1906) says that the song of the hermit warbler "consists of four distinct notes, as a rule, and is described as *zeegle-zeegle, zeegle-zeek*, uttered somewhat slowly at first but ending rather sharply." Barlow (1899) states that "though not loud it would penetrate through the woods quite a distance and very much resembled *tsit, tsit, tsit, tsit, chee chee chee*, the first four syllables being uttered with a gradual and uniform speed, ending quickly with the *chee chee chee*." Grinnell and Storer (1924) write:

> The song of the male Hermit Warbler, while varying somewhat with different individuals, is suficiently distinct from that of the other warblers of the region to make possible identification by voice alone. The song is most nearly like that of the Audubon Warbler but usually not so clear or mellow. A male bird observed at Chinquapin seemed to say *seezle, seezle, seezle, seezle, zeek, zeek;* just that number of syllables, over and over again. The quality was slightly droning, but not so much so as that of the Black-throated Gray Warbler. Another song, clearer in quality, heard in Yosemite Valley, was written *ter'-ley, ter'-ley, ter'-ley, sic', sic'*, thus much more nearly like the song of the Audubon Warbler. Other transscriptions ranged between these two as to timbre. A rendering set down at Glacier Point June 16, 1915, was as follows: *ser-weez', ser-weez', ser-weez', ser', ser'*. The marked rhythm throughout, and the stressed terminal syllables, are distinctive features of the Hermit's song. The call note is a moderate *chip*."

Writing of warbler songs of early dawn, Dawson (Dawson and Bowles, 1909) indulges in the following flowery praise of the hermit's sing: "There is Audubon with his hastening melody of gladness. There is Black-throated Gray with his still drowsy sonnet of sweet content. Then there is Hermit hidden aloft in the shapeless greenery of the under-dawn—his note is sweetest, gladdest, most seraphic of them all, *lilly, lilly, lilly, leê-oleet*. It is almost sacrilege to give it form—besides it is so hopeless. The preparatory notes are like the tinkle of crystal bells, and when our attention is focused, lo! the wonder happens, the exquisite lilt of the closing phrase, *leê-oleet*."

Field marks.—The yellow head, the black throat, the dark back, and the white, unmarked under parts will distinguish the male in spring. The head of the female, of young birds, and of fall birds is also more or less yellowish and the back is more olivaceous. The two white wing bars are also common to several other species. Its song is said to be distinctive.

Fall.—The fall migration of the hermit warbler begins early. Bowles (1906) says that, in Washington, "about the middle of July both young and old assemble in good-sized flocks and frequent the water holes in the smaller growths of timber. At such times I have never seen them associating with any other kinds of birds." W. W. Price wrote to Mr. Barlow (1901) of the migration in the Sierra Nevada:

> The adults are very rare during June and July in the neighborhood of my camp at Silver Creek, but late in July and early in August a migration of the young birds of the year takes place and the species is very abundant everywhere in the tamaracks from about 6000 to 8000 feet. A hundred or more may be counted in an hour's walk at my camp, 7000 feet, on Silver Creek. They are very silent, uttering now and then a 'cheep,' and always busy searching among the leaves and cones for insects. Among some fifty collected in the first week in August, 1896, there were only two or three adults. The young males have the most coloring, but they in no way approach adult plumage. These great flights of the hermit warbler are intermingled with other species, Hammond flycatcher, Calaveras and lutescent warblers, Cassin vireo, and sometimes Louisiana tanagers and red-brested nuthatches. Each year the flight has been noted, it comes without warning of storm or wind, and after a few days disappears to be seen no more.

In the Huachuca Mountains of Arizona, according to Swarth (1904), "they reappeared in August, but at this time were seen only in the pines above 8500 feet. It is rather singular, and in contradiction to the idea that in the migrations the old birds go first in order to show the way, that the first secured in the fall was a young female, taken August 7th. The young birds then became very abundant, and on August 14th the first adult female was taken; and not until August 19th was an adult male seen. The adults then became nearly as abundant as the juveniles, and both together were more numerous than I have ever seen them in the spring, on several occasions as many as fifteen to twenty being seen in one flock."

Winter.—Dr. Skutch writes to me: "The hermit warbler is a moderately abundant winter resident in the Guatemalan highlands, found chiefly between 5,000 and 10,000 feet above sea level, but ranging downward to about 3,500 feet on the Pacific slope and possibly somewhat lower on the Caribbean slope, where pine forests push down into the upper levels of the Tropical Zone. These treetop birds are usually found in the mixed flocks of small birds, of which Townsend's warblers form the predominant element. During the early part of their sojourn in Guatemala, I sometimes saw two, three, or more hermits in the same flock; but in February and March, there was as a rule only one. In 1933, I saw the last of these warblers on the Sierra de Tecpán on March 29, and recorded the first fall arrival on September 13, when four individuals were seen."

DISTRIBUTION

Range.—Western North America from Puget Sound to Nicaragua.

Breeding range.—The hermit warbler breeds **north** to northwestern Washington (Lake Crescent and Tacoma). **East** to the Cascades of Washington (Tacoma); Oregon (Prospect); and the Sierra Nevada in California (Meadow Valley, Pinecrest, Yosemite Valley, Taylor Meadow, and the San Bernardino Mountains). **South** to the San Bernardino Mountains and La Honda. **West** to the Pacific coast from central western California northward (La Honda, Cahto, and Garberville); western Oregon (Kerby and Tillamook); and northwestern Washington (Lake Crescent).

Winter range.—The hermit warbler has been found in winter **north** to central Mexico (Taxco, Cuernavaca, and Mexico City). **East** to Mexico City and central Guatemala (San Gerónimo and Alotepeque). **South** to southern Guatemala (Alotepeque); probably farther south since specimens have been taken at Los Esesmiles, El Salvador, and Metagalpa, Nicaragua. **West** to western Guatemala (Altopeque, Tecpán, and Momostenango); western Oaxaca (La Parada); and northern Guerrero (Taxco).

The hermit warbler has been taken three times in January in central western California (San Geronimo and Point Reyes, Marin County; and Pacific Grove, Monterey County).

Migration.—Late dates of spring departure from the winter home are: Guatemala—Tecpán, March 29. Sonora—Rancho la Arizona, May 8. Arizona—Huachuca Mountains—May 28.

Early dates of spring arrival are: Tampico—Galindo, March 19. Coahuila—Sierra de Guadeloupe, April 20. Arizona—Oracle, April 12. California—Witch Creek, April 10. Washington—Tacoma, April 25.

Late dates of fall departure are: Washington—Edwards, October 19. California—Monterey, October 20. Arizona—Santa Catalina Mountains, September 29. Tamaulipas—Guiaves, October 7.

Early dates of fall arrival are: California—Berkeley, July 9. Arizona—Graham Mountains, July 30. New Mexico—Animas Peak, August 3. Michoacán—Tancitaro, August 16. Guatemala—Tecpán, September 13.

Casual records.—Specimens of the hermit warbler have been collected in the Huachuca Mountains in Arizona on June 16, 1894; at Basin in the Chisos Mountains in Texas on May 3, 1935; and near Cambridge, Minn., on May 3, 1931.

Egg dates.—California: 10 records, May 14 to June 25; 6 records, June 3 to 14, indicating the height of the season.

Washington: 3 records, June 5 to 11 (Harris).

DENDROICA CERULEA (Wilson)

CERULEAN WARBLER

PLATE 39

HABITS

This heavenly-blue wood warbler was first introduced to science, figured, and named by Wilson in the first volume of his American Ornithology. Only the male was figured and described from a specimen received from Charles Willson Peale and taken in eastern Pennsylvania. The female was not known until Charles Lucien Bonaparte described it in his continuation of Wilson's American Ornithology. Strangely enough the discovery of this specimen was also made by a member of the famous Peale family, Titian Peale, the bird having been taken in the same general region, on the banks of the Schuylkill, August 1, 1825. Audubon met with it later, but was almost wholly wrong in what he wrote about it, though his plate is good.

The species is now known to occupy a rather extensive breeding range located mainly west of the Alleghenies and east of the Great Plains from southern Ontario and central New York southward to the northern parts of some of the Gulf States and Texas. It is, however, decidedly local in its distribution over much of this range.

This warbler, a bird of the treetops in heavy deciduous woods, where its colors make it difficult to distinguish among the lights and shadows of the lofty foliage and against the blue sky, is well named cerulean! In his notes from central New York, Samuel F. Rathbun writes: "The type of growth to which the cerulean warbler is partial appears to be the rather open forests in the lowlands and often along some stream. During the nesting season, it will not be found to any extent in the better class of hardwood trees of the uplands; in fact, this warbler shows a strong liking for areas where large elms and soft maples and black ash are the dominant trees." Verdi Burtch wrote to Dr. Chapman (1907) that near Branchport, N. Y., this warbler is "locally abundant in mixed growths of oak and maple with a few birch and hickory." In other portions of its range, it is found in mixed woods of maples, beech, basswood or linden, elm, sycamore, or oaks. Frank C. Kirkwood (1901) found that, in Maryland, "the species has a decided preference for high open woods clear of underbrush. * * * The trees are principally chestnuts, with oaks, hickorys, tulip trees, etc."

Spring.—The main migration route of the cerulean warbler is through the Mississippi Valley, from the Alleghenies westward; it is rare in the Atlantic States, especially the more southern ones, and hardly more than casual in Florida and the West Indies. It enters the United States, in Texas and Louisiana, in April, and reaches its breeding grounds in the interior early in May.

Rathbun (MS.) says of the spring migration in central New York: "The cerulean warbler arrives in this region about the middle of May, its coming being announced by its song. With rare exceptions, it is not found in the spring migration with other warblers and it appears to move in very small groups or singly; even in the large springtime movements of warblers known as 'waves,' some of the birds of which remain while others pass through the region, I have observed very few cerulean warblers. Not much time elapses after its arrival before mating takes place and nest building begins."

Nesting.—The earlier ornithologists knew nothing about the nesting habits of the cerulean warbler; Audubon's description of its nest was entirely erroneous, and it was about 50 years after the bird was discovered that its nest was reported. This is not strange, as the nest is not easy to find and still more difficult to secure. Rathbun (MS.) writes in his notes: "During our stay in New York State, we found only three of its nests, because they were rather difficult to locate. We found the first at a height of 55 feet in a little cluster of small, twig-like branches growing on the side of a feathered elm; these clusters were close enough together to be of great use in climbing the tree, which was at least 3 feet in diameter. The nest was discovered by seeing the bird fly into the cluster. Within the next week a second nest was found by watching the female bird; it was at a height of 45 feet in a very small, flat crotch of a soft maple. The third nest was at a height of about 30 feet.

"The nests were identical in all respects except as to shape, which varied because of its situation. Each was nicely made but not unusual in appearance. The material used was almost wholly the fine strips of the grayish bark of small weed stalks, neatly interwoven. Each was smoothly and beautifully lined with the fresh stems of ground mosses of a brownish red color, which contrasted nicely with the gray outer material. Of great interest was the smoothness with which the material was woven in."

Burtch wrote to Dr. Chapman (1907) that near Branchport, N. Y., where the bird is locally common, "the nest is usually placed on a horizontal branch or drooping branch of an elm, ranging from twenty-five to sixty feet from the ground, and from four, to fifteen, or eighteen feet from the body of the tree *over an opening.*"

W. E. Saunders (1900) reports eight nests found in southern Ontario; two of these were in oaks, 20 and 23 feet up, two in maples, 30 and 35 feet from the ground, and four in basswoods (lindens), from 17 to 50 feet above ground. He gives the measurements of three nests; they measured externally from 1¾ to 2 inches in height and 2¾ inches in diameter; internally they varied from ⅞ to 1 inch in depth and from 1⅞ to 1¾ inches in diameter. He remarks: "A feature that interested me very much was the extreme shallowness of the nests; all the other warblers with which I am acquainted building a comparatively deep nest, and the query arises, Does the bird build a shallow nest because it places it on a substantial limb, or does it place it on a substantial limb because its nests are shallow? The attachment of the nest, also, is exceedingly frail, and I am inclined to think that few of these nests would remain in position long after the young had left."

A nest found by Kirkwood (1901) in Baltimore County, Md., is described as follows: "The nest is made of brown bark fibre, with some fine grass stems among it, and is finished inside with a few black horse-hairs. Outside it is finished with gray shreds of bark, spider web, and a few small fragments of newspaper that had been water-soaked. * * * As the branch sloped, one part of the rim is within ¾ of an inch of it, while the opposite part is 1¾ inches above it, the material comes down on one side of branch to 2¼ inches below the rim. On this side a tiny twig arches out from branch and extending to the rim is embedded in the nest, and the leaves which grew from its top shaded the nest." The nest was 48 feet and 6 inches up from the ground and 15 feet out from the trunk of a tulip tree, with no other limb between it and the ground.

A neat little nest before me is made of materials similar to those mentioned. It is lined with the reddish brown flowering stems of mosses smoothly woven with other very fine brownish fibres into a compact rim, and it is decorated externally with various brown and gray lichens and mosses. Other nests have been reported in sycamores, beeches, rock maples, sugar maples, and white oaks.

Eggs.—The cerulean warbler lays from 3 to 5 eggs, usually 4. They are ovate to short ovate and have a slight luster. The ground color is grayish white, creamy white, or even very pale greenish white, and they are speckled, spotted or blotched with "bay," "chestnut," or "auburn," intermingled with spots of "light brownish drab," or "brownish drab." Some eggs have spots scattered all over the surface, but usually they are concentrated at the large end, where a loose wreath is formed. Generally the eggs are finely marked, but occasionally are quite heavily blotched. The measurements of 50 eggs average 17.0 by 13.0 millimeters; the eggs showing the four extremes measure **17.9** by 13.0, 17.0 by **13.7**, **16.0** by 12.4, and 17.2 by **12.0** millimeters (Harris).

Young.—The period of incubation seems to be unknown, and we have no information on the care and development of the young. Incubation is said to be performed by the female alone, but both parents assist in feeding the young. After the young are out of the nest, they may be seen travelling through the woods in family parties with their parents. There seems to be no evidence that more than one brood is raised in a season.

Plumages.—Ridgway (1902) describes the young cerulean warbler in nestling (juvenal) plumage as "above uniform brownish gray (deep drab gray), the pileum divided longitudinally by a broad median stripe of grayish white; sides of head (including a broad superciliary stripe) and entire under parts white; a narrow postocular stripe of deep drab gray; wings as in adults, but edgings greenish rather than bluish."

The first winter plumage is assumed by a partial postjuvenal molt, involving the contour plumage and the wing coverts, but not the rest of the wings nor the tail. Dr. Dwight (1900) describes the young male in this plumage as "above, deep bice-green, partly concealing cinereous gray which is conspicuous on the rump and upper tail coverts, the latter and the feathers of the back often black centrally. The wing coverts with bluish cinereous gray edgings; two wing bands white, faintly tinged with canary-yellow. Below, white, strongly washed except on the chin, abdomen and crissum with primrose-yellow, the sides and flanks streaked obscurely with dull black. Superciliary line primrose-yellow; lores and orbital regions whitish; a dusky transocular streak."

The first nuptial plumage is acquired by a partial prenuptial molt "which involves much of the body plumage and wing coverts, but not the rest of the wings nor the tail. The grayish cerulean blue, the black streaks on the back and the white wing bands are acquired; below, the plumage is white with a narrow bluish black band on the throat and the sides distinctly streaked. Young and old become practically indistinguishable, except by the duller wings and tail of the juvenal dress."

The adult winter plumage is acquired by a complete postnuptial molt in July, which he says "differs from first winter in being much bluer and whiter, the wings and tail blacker and the edgings a bluer gray. Resembles the adult nuptial, but rather grayer on the back and the throat band incomplete." The adult nuptial plumage is acquired by a partial-prenuptial molt as in the young bird.

He says of the plumages of the female: "The plumages and moults correspond to those of the male. In juvenal plumage the edgings of the wings and tail are greener tinged than those of the male. In first winter plumage the green above is duller and the black of the back and tail coverts is lacking; below there is more yellow and the side streaks are obscure. The first nuptial plumage is acquired by a moult limited chiefly to the head and throat which become bluer and whiter respectively. Later plumages are brighter, but green always replaces the blue of the male."

Food.—No thorough study of the food of the cerulean warbler seems to have been made, but it is known to be insectivorous, foraging among the foliage, twigs, branches, and even on the trunks of trees. It is an expert fly catcher, darting out into the air for flying insects. A. H. Howell (1924) says that "examination of 4 stomachs of this species taken in Alabama showed the food to consist of Hymenoptera, beetles, weevils, and caterpillars." Professor Aughey (1878) observed this warbler catching locusts in Nebraska.

Behavior.—S. Harmsted Chubb (1919) describes the behavior of the cerulean warbler as follows:

> A bird more difficult to observe I have rarely if ever met with. His life seemed to be confined almost entirely to the tops of the tallest deciduous trees, where he would generally feed, with apparent design, on the side most remote from the would-be observer, exhibiting a wariness not expected on the part of a warbler, and finally leaving the tree, the first intimation of his departure being a more distant song. He never remained in the same tree top more than eight or ten minutes at a time and yet rarely ventured out of hearing distance from the center of his range. Fortunately, he would sometimes take a perch on a bare twig and sing for several minutes, but the perch was always high and generally with the sky as a poor background for observation. Had it not been for the almost incessant singing, being heard almost constantly from daybreak until nearly dark, the task of identification would have seemed hopeless.

Voice.—Aretas A. Saunders writes to me: "I have but six records of the song of this bird. There is probably more variation in the song than these records show, for all six are much alike. The song consists of four to eight notes, of even time and all mainly on one pitch, followed by a trill about a tone higher, the latter, in all of my records, pitched on C''''. The first notes, in one of my records, are upward slurs, and in two others the first note of the group slurs upward, but in all of the others all of the notes are of even pitch and not slurred. The pitch varies from G''' to C''''. The songs are undoubtedly between one and two seconds in length, but I had no stop watch at the time, so did not time them. The song is rather loud and not particularly musical. In form the song is much like that of the Blackburnian warbler, but the loudness, different quality, and lower pitch distinguish it."

Francis H. Allen (MS.) writes the song as "*wee wee wee wee bzzz*, heard many times without any apparent variation." This was somewhat different from the song of a cerulean I heard, which had a "chippy" beginning that suggested the song of a yellow palm warbler, and also that of the parula warbler. Rev. J. J. Murray writes to me from Virginia: "The songs of the parula and cerulean in this section are very similar, but not difficult to distinguish. The pattern is reversed in the two; the parula's song is 'bzz, bzz, bzz, trill', while that of the cerulean is a 'trill, trill, trill, bzz'. The cerulean's song can be expressed by the phrase '*Just a little sneeze.*'" A. D. DuBois tells me that "the beginning of the song is similar to that of the redstart, but it ends with a fine, 'wiry,' grasshopper-like trill, ascending in pitch and drawn out to nothing at the end." Mr. Chubb (1919) describes two songs of the cerulean warbler as follows:

> The musical exercises of the bird consisted of an alternation of two distinctly different songs, so different indeed that until the bird was caught in the act we never for a moment suspected a single authorship. One song suggested slightly that of the Magnolia Warbler but rather softer, four syllables, though not quite so well defined as in the Magnolia. The other, for want of something better, might be compared with the song of the Parula Warbler, a short buzzing trill rising in the scale, much louder and less lispy than the song of the Parula. The songs were each of about one second duration, rendered approximately eight or ten times per minute. Altogether the performance was quite musical, in sweetness far above the average warbler song. These two songs were generally alternated with clock-like regularity, though occasionally the bird preferred to dwell upon one or other of his selections for the greater part of the day.

Kirkwood (1901) says: "It also gives its song in a low tone as if it whispered it, and unless the bird is carefully watched the observer might be led to believe that he heard a second bird singing in the distance. I have watched a bird sing thus between each regular song, at other times it would not give it at all, or only occasionally, while on two or three occasions I heard it given for quite a while to the exclusion of the regular song, and quite often have heard it given two or three or even more times in succession between regular songs." He has heard the cerulean warbler singing through July and until the middle of August; on August 19, he heard them singing "immature or imperfect (?) songs."

Enemies.—The cerulean warbler is a rather uncommon victim of the eastern cowbird; not more than 10 cases seem to have been recorded.

Field marks.—No other American wood warbler has a similar shade of heavenly blue on its back as the male cerulean; its under parts are pure white, relieved by a narrow black necklace, and it has two white wing bars. Females, young birds, and even fall males are similar, and are tinged with blue above and with pale yellow below, with a whitish or yellowish line over the eye. In this plumage they resemble the young parula warbler, but the latter is much deeper yellow on the breast and has no line over the eye.

Fall.—Rathbun says in his notes from central New York: "When July comes the warblers will be found quite widely dispersed in any sort of forest, because they are now moving through the country in little family groups. Now and then will be heard snatches of the spring song. This is but preparatory for their departure from the region, which takes place in the latter part of August; we have never seen this warbler after the first week in September.

Professor Cooke (1904) writes:

> The cerulean warbler is a rare migrant in the States along the Atlantic coast, though it has been noted in the Carolinas, Georgia, and Florida. In northeastern Texas and Louisiana it is not uncommon. Its main route of migration seems to cross the Gulf of Mexico chiefly from Louisiana and Mississippi. The species is one of the first to start on the southward migration. By the middle of summer it has reached the Gulf coast and is well on its way to its winter home. At Beauvoir and Bay St. Louis, on the coast of Mississippi, it has appeared in different years on dates ranging from July 12 to 29. For a few days it is common, attaining the height of its abundance about the first week in August. It then passes southward so rapidly that Cherrie was able to record its presence on August 24, 1890, at San José, Costa Rica. By November it reaches central Ecuador. Though the bulk of the birds perform their migration at this early date, some laggards remain behind until late in the season.

Dr. A. F. Skutch tells me it is "exceedingly rare in Guatemala. * * * I have never seen the cerulean warbler in Central America. In Ecuador, I found a male in the Pastaza Valley, at an altitude of about 4,000 feet, on October 15, 1939. Two days later this warbler had become fairly common in this locality, and I saw several individuals.

Winter.—Says Professor Cooke (1904): "The cerulean warbler is chiefly found in winter in South America from Panamá south to Perú, in which country it seems to have its center of abundance. In western Perú Jelski (Taczanowski, Proc. Zool. Soc. London, p. 508, 1847) found it common at Monterico and other places in the mountains east of Lima at 10,000 to 13,000 feet elevation, always in wandering flocks, which were sometimes quite large and contained both old and young birds."

DISTRIBUTION

Range.—North and South America from southern Canada to Perú and Bolivia.

Breeding range.—The cerulean warbler breeds **north** to southern Minnesota (Minneapolis); southern Wisconsin (Barahoo Bluffs, Madison, and Racine, possibly as far north as New London); central Michigan (Saginaw, Locke, and Detroit); southern Ontario (Thedford, Plover Mills, Warren, and Delta; perhaps Manotick); and southern New York (Lockport, Rochester, Ithaca, Santa Cruz Park, and Wappingers Creek, Dutchess County). **East** to southeastern New York (Dutchess County); rarely northeastern Maryland (Towson); southwestern Delaware (Seaford); western Virginia (Charlottesville and Natural Bridge); western North Carolina (Morganton and Pink Beds); and northern Georgia (Lumpkin County and Atlanta). **South** to north-central Georgia (Atlanta); south-central Alabama (Autaugaville and Greensboro); northern Louisiana (Monroe and Caddo Lake); and northern Texas (Texarkana and Dallas). **West** to northeastern Texas (Dallas); northeastern Oklahoma (Copan); southeastern Kansas (Independence); eastern Nebraska (Omaha and Pilgrim Hill, Dakota County); western Iowa (Sioux City); and southern Minnesota (Minneapolis).

Winter range.—The winter home of the cerulean warbler is northwestern South America, in the valleys of the Andes from central Colombia (Antioquia, Medellín, and Bogotá) through Ecuador (Río Napo, Sara-yacu, and the Pataza Valley); to southern Perú (Huachipa and Lima). It has also been found occasionally or accidentally in central northern Venezuela (Rancho Grande); and in western Bolivia (Nairapi and Tilotilo near La Paz). Casual in winter or migration in the Cayman Islands and western Cuba.

Migration.—Late dates of spring departure are: Perú—Huambo, March 15. Ecuador—near San José, March 31. Colombia—Buena Vista, March 4. Florida—Pensacola, April 26. Texas—Austin, April 30.

Early dates of spring arrival are: Florida—Dry Tortugas Island, March 23. Alabama—Greensboro, March 26. Georgia—Atlanta, April 13. South Carolina—Clemson (College), April 21. North Carolina—Asheville, April 23. Virginia—Charlottesville, April 13. West Virginia—Wheeling, April 23. Pennsylvania—McKeesport, April 23. New York—Corning, April 25. Louisiana—Grand Isle, March 27. Arkansas—Tillar, April 6. Tennessee—Athens, April 4. Kentucky—Eubank, April 5. Illinois—Olney, April 18. Indiana—Bloomington, April 11. Michigan—Bay City, April 26. Ohio—Toledo, April 20. Ontario—Hamilton, April 25. Missouri—St. Louis, April 12. Iowa—Hillsboro, April 18. Minnesota—Faribault, April 29. Texas—Victoria, March 17. Oklahoma—Copan, March 27. Kansas—Independence, April 24.

Late dates of fall departure are: Ontario—Point Pelee, September 5. Michigan—Detroit, September 5. Ohio—Ashtabula, September 27. Indiana—Whiting, October 4. Illinois—Chicago, September 28. Kentucky—Versailles, September 4. Tennessee—Athens, September 27. Mississippi—Gulfport, September 17. Oklahoma—Copan, October 1. Texas—Austin, September 27. New York—New York, September 18. Pennsylvania—Berwyn, September 29. North Carolina—Raleigh, September 16. Georgia—Augusta, September 16. Alabama—Birmingham, September 21. Florida—Pensacola, September 18. Costa Rica—San José, October 24.

Early dates of fall arrival are: Texas—Austin, July 20. Mississippi—Beauvoir, July 12. Virginia—Sweet Briar, July 20. Georgia—Athens, July 28. Florida—Pensacola, July 23. Costa Rica—Villa Quesada, August 23. Ecuador—Río Oyacachi, August 10. Perú—Huachipa, October 3.

Casual records.—The majority of the cerulean warblers found east of the Allegheny Mountains might be considered as casual. All records for New England should as yet be so considered, though the species has increased in eastern New York in recent years. About 10 individuals have been recorded in Massachusetts; two in Rhode Island, and one in New Hampshire. On June 2, 1924, one was collected at Whitewater Lake, in southwestern Manitoba, the farthest north that the species has been found. There are two records for North Dakota; one near Jamestown on May 28, 1931, and another near Minot on May 24, 1937. A cerulean warbler was recorded near Denver, Colorado, on May 17, 1883, and a specimen collected on September 2, 1936, on Cherry Creek in Douglas County. A bird "observed at the Mimbres during the latter part of April" is the only record for New Mexico. On October 1, 1947, a specimen was collected at the southeastern edge of the Salton Sea in California; and on October 2, 1925, a specimen was collected near La Grulla in the Sierra San Pedro Mártir, Baja California.

Egg dates.—Ontario: 3 records, June 2 to 13.

New York: 22 records, May 29 to July 9; 15 records, June 1 to 4.

Pennsylvania: 5 records, May 16 to 26.

DENDROICA FUSCA (Muller)

BLACKBURNIAN WARBLER

PLATES 40, 41

HABITS

Bagg and Eliot (1937) give the following account of the history of the naming of the Blackburnian Warbler:

> Some time in the later eighteenth century, a specimen (apparently female) was sent from New York to England, and there described and named for a Mrs. Blackburn who collected stuffed birds and was a patron to ornithology. *Blackburniae*—Gmelin's latinization, in 1788, of this English name—was its scientific designation until quite recently, when in an obscure German publication, dated 1776, were discovered a description of a specimen from French Guiana (which is well east of the species' normal winter range), and the name *fusca*, blackish. Wilson recognized the male as a rare transient near Philadelphia, but when he shot a female (apparently, though he called it a male) in the Great Pine Swamp, Pa., he named it *Sylvia parus*, the Hemlock Warbler. Audubon, too, considered the Blackburnian and Hemlock Warblers distinct."

Blackburnian seems to be a doubly appropriate name, for its upper parts are largely black and its throat burns like a brilliant orange flame amid the dark foliage of the hemlocks and spruces. A glimpse of such a brilliant gem, flashing out from its sombre surroundings, is fairly startling.

Throughout most of the eastern half of the United States the Blackburnian warbler is known only as a migrant, mainly from the Mississippi Valley eastward. Its summer range extends from Manitoba eastward to Nova Scotia, from Minnesota to New England, and southward in the Allegheny Mountains to South Carolina and Georgia, in the Lower Canadian and Upper Transition Zones. For its breeding haunts it prefers the deep evergreen woods where spruces, firs, and hemlocks predominate, or often swampy woods where the black spruces are thickly draped with *Usnea*, offering concealment for birds and nests.

In Massachusetts, which is about the southern limit of its breeding range in New England, William Brewster (1888) describes its haunts at Winchendon as follows: "On both high and low ground, wherever there were spruces in any numbers, whether by themselves or mixed with other trees, and also to some extent where the growth was entirely of hemlocks, the Blackburnian Warbler was one of the most abundant and characteristic summer birds, in places even outnumbering the Black-throated Green Warbler, although it shunned strictly the extensive tracts of white pines which *D. virens* seemed to find quite as congenial as any of the other evergreens."

Gerald Thayer wrote to Dr. Chapman (1907) that at Monadnock, New Hampshire, it is "a very common summer resident. It is one of the four deep-wood Warblers of this region, the other three being the Black-throated Blue, the Northern Parula and the Canada. While all the other summer Warblers of Monadnock seem better pleased with various sorts of lighter timber, these four are commonest in the small remaining tracts of primeval woodland, and in the heaviest and oldest second growth. But despite this general community of habit, each of the four has marked minor idiosyncrasies. The Blackburnian favors very big trees, particularly hemlocks, and spends most of its life high above the ground."

Professor Maurice Brooks (1936) says that Blackburnian warblers "are thoroughly at home in the deciduous second-growth timber that in so many places has replaced the coniferous forest. They range down to elevations of 2,500 feet in northern West Virginia. Here they associate with Golden-winged and Chestnut-sided warblers. A favorite perch is on some chestnut tree that has been killed by the blight." Rev. J. J. Murray tells me that, in Virginia, it is "common above 1,500 feet, wherever there are conifers." And Thomas D. Burleigh (1941) says of its status on Mount Mitchell in western North Carolina: "Although not known to breed above an altitude of approximately 5,000 feet, this species is fairly plentiful during the late summer in the fir and spruce woods at the top of the mountain, appearing regularly in July and lingering through September."

Spring.—The Blackburnian warbler is apparently rare in spring in the Atlantic States south of North Carolina; its migration range extends westward to the plains of eastern Texas, eastern Kansas, and eastern Nebraska, but it is rare west of the forested regions of the Mississippi Valley. Professor Cooke (1904) says that the average rate of migration "from the mouth of the Mississippi to its source, where it breeds, appears to be scarcely 25 miles per day." Forbush (1929) writes:

> It is generally regarded as rare in migration in Massachusetts, though probably untold numbers pass over the state every year, but only a few stop here. It is not when the birds are migrating that we see them, but when they *stop* to rest. * * * I can recall but two instances in my lifetime when myriads of Blackburnian Warblers stopped here, though other similar flights probably have come when I was not there to see. At sunrise one morning in early May, many years ago, when the tiny green leaves were just breaking forth on the tall trees of the woods near Worcester, Blackburnians were everywhere in the tree-tops. They swarmed in the woods for miles. Years later, in Amesbury, on another May morning, the night flight, having met a cold wave from the north with a light frost, had come down to earth and the birds were busily looking for food; many Blackburnians and many other warblers were in the low shrubbery, in the grass, and even on plowed fields in every direction all through the village and about the farms. The sudden cold had stopped them. A few hours later as the day grew warmer they disappeared and were not seen again.

Brewster (1906) says: "We see the beautiful Blackburnian oftenest during the later part of May, in extensive tracts of upland woods, where it spends much of its time in the tops of the larger trees, showing a decided preference for hemlocks and white pines. In Cambridge I have repeatedly observed it in our garden and the immediate neighborhood, usually in tall elms or in blossoming apple trees."

Nesting.—So far as I can learn, the nest of the Blackburnian warbler is almost always placed in a coniferous tree at heights ranging from 5 feet to over 80 feet above the ground; nests have been reported many times in hemlocks, which seems to be a favorite tree, but also in spruces, firs, tamaracks, pines and even a cedar. Ora W. Knight (1908) says: "I have found them breeding in colonies as a rule, that is to say, in a rather dense, mossy carpeted tract of evergreen woods near the pond at Pittsfield [Maine], covering perhaps a square mile, there were about ten pairs of these birds to be found, and in a tract of similar woods about half this size at Bangor there are often six or eight pair nesting. In other words, in suitable localities they tend to congregate in loosely scattered assemblies, while in less suitable spots, generally none, or at most a single pair will be found." Of a nest found near Winchendon, Mass., Brewster (1888) writes:

> The nest, which was found by watching the female, was built at a height of about thirty feet above the ground, on the horizontal branch of a black spruce, some six feet out from the main stem. Its bottom rested securely near the base of a short, stout twig. Above and on every side masses of dark spruce foliage, rendered still denser by a draping of *Usnea* (which covered the entire tree profusely), hid the nest so perfectly that not a vestige of it could be seen from any direction. This nest is composed outwardly of fine twigs, among which some of the surrounding *Usnea* is entangled and interwoven. The lining is of horse hair, fine, dry grasses, and a few of the black rootlets used by *D. maculosa*. The whole structure is light and airy in appearance, and resembles rather closely the nest of the Chipping Sparrow.

The highest nest of which I can find any record is one reported by Dr. C. Hart Merriam (1885), found by A. J. Dayan in a grove of large white pines (*Pinus strobus*), in Lewis County, N. Y. It was saddled on a horizontal limb of one of the pines, about 84 feet from the ground and about 10 feet out from the trunk. "The nest is large, substantial, and very compact. It consists almost entirely of a thick and densely woven mat of the soft down of the cattail (*Typha latifolia*), with seeds attached, and is lined with fine lichens, horse hair, and a piece of white thread. On the outside is an irregular covering of small twigs and rootlets, with here and there a stem of moss or a bit of lichen."

The lowest nests that I have heard of are recorded in Frederic H. Kennard's notes from Maine; one was only 5½ feet up and the other 9 feet from the ground in small spruces. Mrs. Nice (1932) found a nest near her mother's home in Pelham, Mass., that was "18 feet from the ground near the top of a cedar among comparatively open, young growth, 40 yards south of the house and 150 yards to the east of the great pines and hemlocks where the male habitually sang." The only nest of this warbler that I have ever seen was found by watching the female building it, on June 16, 1913, on an island in Lake Winnipegosis, Manitoba; it was only about 10 feet from the ground, near the end of a drooping branch of a large black spruce that stood on the edge of some coniferous woods next to an open swale. The nest, shaded from above, was partly concealed from below by dense foliage and was, apparently, well made of soft fibers, deeply cupped, and lined with some dark material and a little willow cotton. I was not able to visit the island again.

In New York State and in Pennsylvania, the nests of the Blackburnian warbler are almost invariably placed in hemlocks. All of the four nests recorded by T. E. McMullen (MS.) from the Pocono Mountains, Pa., were in hemlocks. And Todd (1940) states that with one exception all the nests found by R. B. Simpson, of Warren, Pa., were in hemlocks, "at elevations varying from twenty to fifty feet. The exceptional nest was in a large chestnut, sixty feet from the ground."

Dr. Roberts (1936) mentions a Minnesota nest "situated in an arbor vitae tree, directly over the entrance to a cabin," and one "placed in a small spruce, close to the trunk, about 2 feet from the top of the tree and about 20 feet from the ground. Another was found in "a jack-pine tree, 20 feet from the ground, 6 feet from the trunk, resting in a tangle of small branches, and concealed by a closely overhanging branch."

Eggs.—The Blackburnian warbler lays normally 4 or 5 eggs, usually 4; in a series of 14 sets there are only 3 sets of 5. They are ovate to short ovate and slightly glossy. The ground color is snowy white or very pale greenish white, and is handsomely spotted and blotched with "auburn," "bay," "argus brown," "Mars brown," or "mummy brown," with undertones of "brownish drab," or "light vinaceous-drab." On some eggs the drab marks are the most prevalent, with fewer but more prominent spots or blotches of dark brown shades, such as "Mars brown" and "mummy brown." Others have spots of "auburn" and "bay" so concentrated that they form a solid band around the large end. In addition a few small scrawls of brownish black are often found. Generally speaking the markings tend to form a wreath, but some eggs are spotted more or less evenly all over the surface. The measurements of 50 eggs average 17.2 by 12.8 millimeters; the eggs showing the four extremes measure **18.0** by 13.6, 17.0 by **13.7, 15.6** by 12.5, and 17.1 by **12.0** millimeters (Harris).

Young.—We have no information on incubation and very little on the care of the young. The male has been seen to go onto the nest, and evidently shares occasionally in the duty of incubation. Both parents help in feeding the young, as noted by Mrs. Nice (1932) at the nest she was watching. When Mrs. Nice's daughter climbed a tree near the nest, the female "assumed a peculiar attitude, her tail outspread and dropped at right angles to her body, her wings flipping rapidly and occasionally held stiffly up or down. The excitement caused the young to jump out on the ground where they could not be found."

Plumages.—Dr. Dwight (1900) calls the natal down sepia-brown, and in speaking of the males, describes the juvenal plumage as "above, dark sepia-brown obscurely streaked on the back with clove-brown. Wings and tail clove-brown edged with olive-buff, the tertiaries and coverts with white forming two wing bands at tips of greater and median coverts; the outer three rectrices largely white. Below, white, washed with wood brown or buff on breast and sides, spotted, except on chin, abdomen and crissum, with dull sepia. Superciliary stripe cream-buff, spot on upper and under eyelid white; lores and auriculars dusky."

A partial postjuvenal molt begins early in August, involving the contour plumage and the wing coverts but not the rest of the wings or the tail. This produces the first winter plumage, which he describes as "above, deep yellowish olive-gray, flecked on the crown and streaked on the back with black; obscure median crown stripe straw-yellow; rump and upper tail coverts black, edged with olive-gray. Wing coverts clove-brown edged with olive-gray and tipped with white forming two broad wing bands. Below, straw-yellow brightening to orange-tinged lemon on the throat, fading to buffy white on the crissum and narrowly streaked on the sides with black veiled by yellow edgings. Superciliary stripe and postauricular region lemon-yellow orange-tinged. Auriculars, rictal streak and transocular stripe olive-gray mixed with black. Suborbital spot yellowish white."

He says that the first nuptial plumage is "acquired by a partial prenuptial moult which involves most of the body plumage (except posteriorly), the wing coverts and sometimes the tertiaries but not the rest of the wings nor the tail. The full orange and black plumage is assumed, young and old becoming practically indistinguishable, the orange throat equally intense in both, the wings and tail usually browner in the young bird and the primary coverts a key to age."

The adult winter plumage is acquired by a complete postnuptial molt in July, and "differs little from the first winter dress, but the yellow more distinctly orange, the transocular and rictal streaks, the crown and auriculars distinctly black, veiled with orange tips, the streaking below heavier and broader, the wings and tail blacker and the edgings grayer." The adult nuptial plumage is acquired as in the young bird; this molt evidently begins in February, while the birds are in their winter quarters, and is usually finished before they reach their summer homes.

Of the females, Dr. Dwight says:

> The plumages and moults correspond to those of the male. In juvenal plumage the wing edgings are usually duller, the first winter plumage being similar to that of the male but browner, the yellow tints nearly lost and the streakings obscure and grayish. The first nuptial plumage, assumed by a more or less limited prenuptial moult, is grayer above and paler below, except on the chin and throat where new pale orange feathers contrast with the worn and faded ones of the breast. The adult winter plumage is practically the same as the male first winter, the auriculars and transocular stripe usually duller. The adult nuptial plumage is brighter below than the first nuptial and with more spotting on the crown, but the black head and bright orange throat of the male are never acquired.

Food.—The Blackburnian warbler is mainly insectivorous like other wood warblers, feeding almost entirely on the forest pests that are so injurious to the trees. F. H. King (1883), writing of its food in Wisconsin, says: "Of nine specimens examined, four had eaten nine small beetles; five, nineteen caterpillars; one, ants; and one, small winged insect. In the stomachs of three examined collectively, were found four caterpillars, four ants, one dipterous insect .09 of an inch long, one medium sized heteropterous insect, four large crane-flies, and one ichneumon-fly (?). Another bird had in its stomach one heteropterous insect (*Tingis*), nine small caterpillars, two leaf-beetles, and two large crane-flies."

Ora W. Knight (1908) writes: "In general I have found large quantities of the wing cases and harder body portions of beetles in the stomachs of such Blackburnian Warblers as I have dissected, also unidentifiable grubs, worms, larvae of various lepidopterous insects and similar material. As a rule they feed by passing from limb to limb and examining the foliage and limbs of trees, more seldom catching anything in the air."

R. W. Sheppard (1939), of Niagara Falls, Ontario, observed a male Blackburnian warbler in his garden for several days, November 5 to 11, 1938, that appeared to be traveling with two chickadees, among some willow trees. "An examination of the row of low willow trees which appeared to be so attractive to this particular warbler, revealed the presence of numbers of active aphids and innumerable newly laid aphis eggs, and it is probable that these insects and their eggs provided the major incentive for the repeated and prolonged visits of this very late migrant."

Henry D. Minot (1877) observed "a pair feeding upon ivy berries" on April 21, when insects were not yet common in Massachusetts.

Behavior.—William Brewster (1938) describes what he thought was the unique behavior of a female Blackburnian warbler at its nest, although a similar habit has been observed in other wood warblers. Even though the eggs "were perfectly fresh the female sat so closely that thumping and shaking the tree (a slender one) failed to start her, and when Watrous climbed it he nearly touched her before she slipped off. She then dropped like a stone to the ground over which she crawled and tumbled and fluttered with widespread tail and quivering wings much like a Water Thrush or Oven Bird and evidently with the hope of leading us away from the nest."

The Blackburnian is preeminently a forest warbler and a treetop bird. On migrations it frequents the tops of the trees in the deciduous forests, often in company with other wood warblers; and on its breeding grounds in the coniferous forests the male loves to perch on the topmost tip of some tall spruce and sing for long periods, his fiery breast gleaming in the sunlight. As his mate is probably sitting on her nest not far away, his serenity may be disturbed by the appearance of a rival; but the intruder in his territory is promptly driven away and he resumes his singing.

Voice.—Aretas A. Saunders has sent me the following study: "The song of the Blackburnian warbler is one that is usually of two distinct parts, the first a series of notes or 2-note phrases all on one pitch, and the second a faster series, or a trill, on a different pitch. It is very high in pitch, with a thin, wiry quality, rather unmusical, and not loud but penetrating.

"Of my 34 records, 25 have the second part higher in pitch than the first, while in the other 9 it is lower. I do not think, however, that this means that the higher ending is commoner, for there is reason to think that the difference is geographical. Of 11 records of migrating birds in Connecticut, 10 end in the higher pitch. Of 15 records from breeding birds in the Adirondacks, 13 end in the higher pitch; but of 8 records of breeding birds in Allegany State Park in western New York, only 2 end in the higher pitch, and 6 in the lower.

"In 20 of the records the first part of the song is of 2-note phrases, but the remainder is of single repeated notes. In 6 records, ending in a higher pitch, the final trill slurs upward in pitch, suggesting the ending of a typical parula song in form. In 10 of the records the second part is much shorter than the first.

"Songs vary from 1⅗ to 2⅗ seconds, averaging a little longer than those of other species of this genus. The number of notes in songs, excepting those with trills, varies from 7 to 25, and averages 14. Pitch varies from D'''' to F'''', one and a half tones more than an octave. It ranks with the blackpolled and bay-breasted warblers in the very high pitch of its upper notes but shows more variation in pitch than either.

"The song of this bird ceases earlier in summer than most others. In 14 summers in Allegany Park, the average date of the last song was July 12, the earliest July 4, 1929, and the latest July 22, 1935. I have never heard singing in late summer after the molt."

Francis H. Allen sends me his impressions as follows: "Like so many of our warblers, the Blackburnian has two song-forms, but both are subject to great individual variation. An extremely high note is almost an invariable characteristic. In one form it is the closing note, and in the other it ends each repeated phrase of a succession that constitutes the main part of the song. The first song resembles that of the parula, but ends with this high note, while the main part is less buzzy and more what I might call pebbly in character. The second I have been accustomed to call the chickawee song because of the repeated phrase which suggests those syllables. At Sherburne, Vt., in June, 1907, I found the Blackburnians singing a song that I rendered as *chĭ-ee chĭ-ee chĭ-ee chĭ-ee chip.* Another rendering of the same or a similar song, recorded at Jaffrey, N. H., May 30, 1910, was *serwée serwée serwée serwée serwíp*, with the emphasis on the *wip*. At New London, N. H., in June, 1931, where this was perhaps the commonest of the warblers, I was particularly impressed by the variability of both the songs. In some, the very high and attenuated notes were so short that for some time I failed to recognize their source. One bird sang *chiddle chiddle chiddle chick-a chick-a cheet*. At Hog Island in Muscongus Bay, Maine, in June, 1936, I heard a song of which only a sweet *weet weet weet weet* carried to a distance, but of which, heard near at hand, the end was found to be a short, confused succession of high-pitched, dry notes concluding with a very high, short note. This was, I think, the most pleasing performance I have ever heard from this species."

Mrs. Nice (1932) mentions three different songs; the commonest and shortest, like the parula's in form, lasts for one second and is given at intervals of 7½ to 10 seconds; the rarest and longest lasts for two seconds and is given at intervals of 10 or 14 seconds.

A. D. DuBois tells me that the Blackburnian warbler "has a song not unlike that of the dickcissel in its general form, although much subdued in volume." Gerald Thayer wrote to Dr. Chapman (1907) of two or more different songs of this warbler, and says:

> Its voice is thin, but, unlike the Parula's, exquisitely smooth, in all the many variations of its two (or more) main songs. * * * Even the tone quality is not quite constant, for though it never, in my experience, varies toward huskiness, it does occasionally range toward full-voiced richness. Thus I have heard a Blackburnian that began his otherwise normal song with two or three clear notes much like those of the most full and smooth-voiced performance of the American Redstart's, and another that began so much like a Nashville that I had to hear him several times, near by, to be convinced that there was not a Nashville chiming in. Sometimes, again, tone and delivery are varied toward excessive languidness; and sometimes, contrariwise, toward sharp, wiry "thinness."

Enemies.—Dr. Friedmann (1929) calls the Blackburnian warbler "a very uncommon victim of the Cowbird." Dr. Merriam (1885) records a nest of this warbler that was 84 feet from the ground, containing four warbler's eggs and one of the cowbird, of which Friedmann remarks: "This is probably the altitude record for a Cowbird's egg, bettering by some twenty feet my highest record at Ithaca, a Cowbird's egg in a nest of a Pine Warbler about sixty feet up."

Harold S. Peters (1936) records two species of lice, *Menacanthus chrysophaeum* (Kellogg) and *Ricinus* pallens (Kellogg), and one mite, *Proctophyllodes* sp., as external parasites of this warbler.

Field marks.—The adult male Blackburnian warbler in spring plumage is unmistakable, with its black upper parts, large white patch in the wings, orange stripe in center of the crown and another over the eye, and, especially, the flaming orange throat and breast. The female in the spring and the male in the fall are similarly marked, but the colors are much duller. The colors of young birds in the fall are even duller, and the back is brownish, but the white outer web of the basal half of the outer tail feather should indicate the species.

Fall.—Early in August, young and old birds begin to gather into flocks preparing to migrate, and before the end of that month most of them have left their breeding grounds. All through August and most of September, we may see them drifting through our deciduous woods in mixed flocks with other species of warblers. These migrating flocks are generally so high up in the tree tops and are so active in their movements that it is not easy to identify them in their dull winter plumages.

By early October, most of the Blackburnian warblers have passed beyond the United States, en route to their winter home in South America. Professor Cooke (1904) says: "By the middle of October the earliest migrants have reached Venezuela and Ecuador. The main army of the Blackburnians pass the south end of the Alleghenies between September 25 and October 5, and during the first two weeks of October are moving through San José, Costa Rica, and by early in November are settled for the winter in Perú."

Dickey and van Rossem (1838) refer to it as a "fairly common fall migrant and very rare winter visitant in the Arid Lower Tropical Zone" in El Salvador, but "not seen in spring."

Winter.—Dr. Alexander F. Skutch contributes the following notes: "Rarely recorded, and apparently only as a bird of passage, in Guatemala, the Blackburnian warbler is a moderately abundant winter resident in Costa Rica. Here it passes the winter months on both slopes of the Cordillera, from about 1,500 to 6,000 feet above sea-level, but is far more abundant above than below 3,000 feet. It is found in mid-winter both in heavy forest and among scattered tall trees. Although the birds appear to arrive in flocks in late August or September, they soon disperse through the woodland and show slight sociability. Yet one or two may at times join a mixed flock of Tennessee warblers and other small birds. Restlessly active, the Blackburnian warbler forages well above the ground, where it is difficult to see. I have never heard its song in Central America.

"Early dates of fall arrival are: Guatemala—Chimoxan (Griscom), October 1; Panajachel (Griscom), October 4. Costa Rica—San José (Cherrie), September 8; San José (Underwood), Septem 10; La Hondura (Carriker), September 19; San Isidro de Coronado, September 8, 1935; Vara Blanca, August 19, 1937; Cartago, September 13, 1938; Murcia, September 14, 1941; Basin of El General, September

16, 1936; Ujarrás (Carriker), September 12. Ecuador—Volcán Tungurahua, 7,400 feet, October 12, 1939.

"Late dates of spring departure from Central America are: Costa Rica—Basin of El General, March 25, 1936, March 13, 1937 and April 18, 1943; Vara Blanca, May 7, 1938; Pejivalle, April 23, 1941; Bonilla (Basulto), April 10. Guatemala—Finca Sepacuite (Griscom), May 10."

DISTRIBUTION

Range.—Southern Canada east of the Great Plains to Central Perú.

Breeding range.—The Blackburnian warbler breeds **north** to southern Manitoba (Lake St. Martin and Berens Island, Lake Winnipeg); central Ontario (Lac Seul, Lake Abitibi, and North Bay; has occurred at Trout Lake); and central Quebec (Blue Sea Lake, Lake Albanel, rarely; Lake St. John and Gaspé; possibly Pointe de Monts and Natashquan). **East** to eastern Quebec (Gaspé); eastern New Brunswick (Bathurst and Tabusintac); and eastern Nova Scotia (Antigonish and Halifax). **South** to Nova Scotia (Halifax); southern Maine (Calais, Lewiston, and Portland); Massachusetts (Cambridge, Springfield, and Sheffield); northern New Jersey (Kittatinny Mountains); central Pennsylvania (Mauch Chunk and Carlisle); and south through the mountains of Maryland, Virginia, West Virginia, North and South Carolina and Tennessee to northern Georgia (Brasstown Bald and Burnt Mountain); western Pennsylvania (Leasureville and Meadville); northeastern Ohio (Pymatuning Swamp and possibly Geneva); northern Michigan (Bay City and Wequetonsing); northern Wisconsin (New London, Unity and Ladysmith); and northern Minnesota (Elk River, Onamia, and Itasca Park). **West** to northwestern Minnesota (Itasca Park) and southeastern Manitoba (Winnipeg and Lake St. Martin).

A possible future extension of range westward is seen in records from Saskatchewan: it was recorded four times near Indian Head 1888–1901; one at Last Mountain Lake in 1920, at Lake Johnston in 1922; and at Emma Lake in the summer of 1939, possibly breeding.

Winter range.—The Blackburnian warbler is reported to winter commonly in Costa Rica, but as yet has been found in Panamá only as a migrant. In South America it is found **north** to northern Colombia (Santa Marta region); and central northern Venezuela (Rancho Grande). **East** to northwestern Venezuela (Rancho Grande, Mérida, and Páramo de Tamá); the eastern slope of the Andes in Colombia (Pamplona, Bogotá, and San Antonio); Ecuador (Mount Sumaca, Machay, and Zamora); and Perú (Chinchao and Huambo). **South** to central Perú (Huambo and Anquimarca). **West** to western Perú (Anquimarca and Tambillo); Ecuador (Ambato, Quito, and Parambo); and Colombia (Concordia, Medellín, and the Santa Marta region). It is casual in migration in the Bahamas and Cuba.

Migration.—Late dates of spring departure from the winter home are: Perú—Chelpes, April 22. Ecuador—Quito, May 10. Venezuela—Rancho Grande, April 22. Colombia—La Porquera, April 24. Costa Rica—Vera Blanca, May 7.

Early dates of spring arrival are: Panamá—Garachiné, March 5. Florida—Pensacola, April 5. Alabama—Hollins, April 4. Georgia—Athens, March 29. South Carolina—Aiken, April 17. North Carolina—Weaverville, April 16. Virginia—Lynchburg, April 25. West Virginia—White Sulphur Springs, April 17. District of Columbia—Washington, April 23. Pennsylvania—Renovo, April 27. New York—Rochester, April 26. Massachusetts—Melrose, April 29. Vermont—Wells River, April 30. Maine—Portland, May 4. New Brunswick—Scotch Lake, May 5. Quebec—Montreal, May 10. Louisiana—Lake Borgne, March 27. Mississippi—Gulfport, March 27. Tennessee—Chattanooga, March 31. Kentucky—Lexington, April 12. Indiana—Brookville, April 15. Ohio—Oberlin, April 19. Michigan—Hillsdale, April 22. Ontario—London, April 27. Arkansas—Huttig, April 15. Missouri—Bolivar, April 20. Iowa—Davenport, April 28. Wisconsin—Unity, April 27. Minnesota—Waseca, April 30. Texas—Boerne, March 31. Nebraska—Stapleton, May 1. South DakotaVermilion, May 3. Monitoba—Aweme, May 14.

Late dates of spring departure of transients are: Florida—Pensacola, May 9. Alabama—Autaugaville, May 12. Georgia—Athens, May 7. South Carolina—Spartanburg, May 12. North Carolina—Greensboro, May 17. Virginia—Charlottesville, May 28. District of Columbia—Washington, June 3. Pennsylvania—Norristown, May 30. New York—New York, June 7. Louisiana—New Orleans, April 23. Mississippi—Corinth, May 12. Kentucky—Lexington, May 16. Illinois—Lake Forest, June 9. Ohio—Toledo, June 12. Arkansas—Rogers, May 12. Missouri—Kansas City, May 30. Iowa—Sigourney, June 1. Texas—Commerce, May 18. Nebraska—Fairbury, May 26. South Dakota—Yankton, June 2.

Late dates of fall departure are: Saskatchewan—Last Mountain Lake, September 1. Nebraska—Fairbury, October 14. Texas—Brownsville, October 2. Minnesota—Saint Paul, September 25. Wisconsin—Madison, September 27. Ontario—Hamilton, October 3. Michigan—Ann Arbor, October 8. Indiana—Waterloo, October 17. Kentucky—Danville, October 16. Missouri—St. Louis, October 6. Tennessee—Memphis, October 28. Arkansas—Chicat, October 4. Mississippi—Eudora, October 24. Louisiana—New Orleans, October 9. Quebec—Hatley, September 30. New Brunswick—Scotch Lake, September 28. Maine—Phillips, September 17. New Hampshire—

Hanover, September 24. Massachusetts—Wellesley, October 23. New York—Canandaigua, October 12. Pennsylvania—Berwyn, October 19. District of Columbia—Washington, October 10. West Virginia—Bluefield, October 8. Virginia—Sweet Briar, November 1. Georgia—Tifton, November 2. Alabama—Birmingham, October 25. Florida—Arcadia, October 30. Cuba—Bosque de la Habana, October 30.

Early dates of fall arrival are: North Dakota—Argusville, August 23. Texas—Commerce, August 28. Illinois—Glen Ellyn, August 19. Ohio—Little Cedar Point, July 31. Kentucky—Versailles, August 31. Tennessee—Nashville, August 29. Mississippi—Bay St. Louis, August 11. New York—New York, August 11. Pennsylvania—Berwyn, August 19. District of Columbia—Washington, August 2. Virginia—Charlottesville, August 10. North Carolina—Mount Mitchell, July 30. Georgia—Savannah, August 10. Florida—Key West, July 29. Cuba—Santiago de las Vegas, September 20. Costa Rica—San José, August 17. Colombia—Santa Isabel, September 22. Venezuela—Escorial, October 14. Ecuador—Tumbaco, October 12. Perú—Tambillo, November 19.

Casual records.—A specimen of Blackburnian warbler was collected at Frederickshaab, Greenland, on October 16, 1845. One was taken at Ogden, Utah, in September 1871, and another near Fort Bayard, N. M., in May 1876. On August 21, 1924, a male was watched closely for sometime near Libby, Mont.

Egg dates.—Maine: 5 records, June 2 to 17.

New York: 23 records, May 29 to July 6; 16 records, June 7 to 17, indicating the height of the season.

New Hampshire: 6 records, May 23 to June 18.

Pennsylvania: 5 records, May 28 to June 9.

Quebec: 2 records, June 15 and 20.

DENDROICA DOMINICA DOMINICA (Linnaeus)

EASTERN YELLOW-THROATED WARBLER

CONTRIBUTED BY ALEXANDER SPRUNT, JR.

PLATES 42, 43

HABITS

One of the botanical attractions of the South is the Spanish moss (*Tillandsia usneoides*) that drapes with its graceful, swaying strands the cypresses in the lagoons and backwaters, the live oaks that stand in spectacular avenues on the approaches of so many plantations of the Carolina Low Country and in magnificent groves throughout the Coastal Plain, and even the pines that forest wide reaches of Georgia and northern Florida. To many ornithologists the thought of this

Spanish moss brings to mind the birds partial to it, particularly the eastern yellow-throated warbler. Indeed, in the coastal part of the range of this bird the two are all but synonymous, so that where the moss is scarce, so, too, is the eastern yellow-throated warbler. Since childhood I have thought of this little gray and yellow sprite, one of the handsomest of a handsome tribe, as the animated spirit of the Spanish-moss country.

Spring.—The eastern yellow-throated warbler is much less migratory than many species of its genus. In the southern portion of its range it is a permanent resident, though of course, quiet at that season and therefore difficult to find; but it occurs throughout the year and can be seen on almost any day in winter from the Charleston, S. C., area southward to Lake Okeechobee, Fla.

In Florida, though it is resident in much of the state, a marked increase of migrants from the south occurs in late February and early March. Arthur H. Howell (1932) states that "the beginning of spring migration is indicated by the appearance of the birds at Sombrero Key Light March 11th." He also states that F. M. Chapman noted arrivals at Gainesville on March 2. (Some birds are mated by March 11 in the vicinity of Charleston.) Thus, the spring migration seems a rather erratic and long-drawn-out movement.

In the Pensacola region of Florida, F. M. Weston (MS.) writes: "Birds that have wintered commence singing, and thus become conspicuous, early in March. Incoming migrants gradually add to the number until, by the first of April, the species is common and widely distributed in all areas where Spanish moss is present. Howell considers this species as one of the typical birds of the pine forests, but in this region, where the moss is never found in pure stands of pine, the bird is absent from the pine woods. In the Dead Lakes area, south of Marianna, Fla., a drowned cypress swamp, the cypresses are covered with dense masses of moss and the yellow-throated warbler is one of the characteristic birds."

Arrival dates in Georgia are similar to those in South Carolina. Around Charleston, there are comparatively few birds in evidence from November until late February, though individuals may be seen throughout this period. The barrier islands, typified by Bull's Island, seem to be favorite wintering localities. In late February the song period begins, coinciding with a distinct influx from the south, and soon the birds seem almost everywhere. Arthur T. Wayne (1910) puts the twenty-seventh of the month as the advent of the spring migration in Charleston. This coincides with all my observations, though some variation may occur when the spring is early or late.

In North Carolina the bird is much more common in the coast region than the interior, but does occur scatteringly in the middle portion of the state and sometimes considerably to the westward. It is absent in the mountains but a few may be noted in the valleys of the foothills. According to the findings of Pearson and the Brimleys (1942) it appears about Raleigh on March 9. Probably the coastal areas are visted earlier, perhaps by March 1. Uncertainty prevails regarding the arrival of birds in the western parts of the state. These authors quote T. D. Burleigh as stating that the earliest date near Asheville is March 28, 1935, and that "at no time were any seen on the mountainsides."

In Virginia one finds this warbler appearing in the Tidewater area "as early as March 20th," according to H. H. Bailey (1913). May T. Cooke (1929) states that it usually comes to the Washington region around April 15, the earliest record being March 30. Its summer status there is characterized as "local"; moist woodlands along the Potomac River are its favorite spots. Further inland, Ruskin H. Freer (MS.) says that he has seen it but twice at Lynchburg, on April 11, 1933, and September 30, 1930. Lynchburg, in the foothills of the Blue Ridge, is probably a western limit.

Professor E. A. Smyth never saw it in Montgomery County and J. J. Murray (MS.) has not recorded it about Lexington in Rockbridge County (MS.), localities in the Shenandoah Valley of Virginia. According to Dr. Murray "the bird is unknown west of the Blue Ridge in Virginia. It is a migrant in the foothills and upper Piedmont on the eastern side of the Blue Ridge. From Washington south through central Virginia it is an uncommon summer resident in the eastern third of the State, becoming more common as the coast is approached, but even in the tidewater region and on the Eastern Shore it is abundant only locally."

My experience with this warbler in Virginia is limited to the southern portion of the Eastern Shore. There, in the area about Eastville, Cheriton, and Cape Charles during June and half of July 1940, I found it fairly numerous in the woodlands but discovered no nests. This locality appears to be the extreme northern limit of the Spanish moss for only a few bedraggled clumps were noted in the woods near Eastville on the Chesapeake Bay side of the peninsula. This moss ceases to be prevalent as one comes to the bay on the Norfolk side and the dejected evidences of the growth across that body of water suggest that it may have had its origin in windblown shreds that gained and maintain a precarious foothold.

Nesting—It is in its domestic habits that *dominica* exhibits its unalterable affinity for *Tillandsia usneoides* where the ranges coincide. The nest is rarely placed anywhere except in a clump of it, and the tree concerned is usually an oak, as this species offers more foothold for the Spanish moss than others and, as a consequence, is more heavily draped. Although I have found nests both in pines and cypresses, there is little question but that the live oak holds them more often than any other tree. The long plantation avenues are splendid sites, and Arthur T. Wayne once told me that he had climbed every tree in the long approach to Oakland Plantation in Christ Church Parish near Charleston, for nests of this bird!

The height at which the nest is placed varies from 10 or 12 feet to 50 or 75, and in some cases to nearly 100. The lowest nest I ever found was in my yard (in 1943); it was built in a clump of moss in a cassina bush (*Ilex vomitoria*) barely 3½ feet from the ground. However, the average height might be put at about 35 feet.

Nest building materials are not of wide choice, usually consisting of fine grasses, caterpillar silk, weed stems, and plant down, with a lining of plant down or sometimes feathers. The moss among which the nest is suspended is woven into the structure to some extent. Horsehair and skeletonized leaves are sometimes employed. The nest is fairly deeply cupped and averages about 3 inches in outside diameter, 2½ in inside diameter, and the same in depth. The writer has never seen a nest not built in moss, but Wayne (1910) gives two other locations in coastal South Carolina, his only such in 50 years of field work. Both were in short-leaf pines, one 45 and the other 50 feet up, and both were hidden in masses of needles and burs, invisible from below. One of these nests is in the Brewster collection and the other in J. E. Thayer's.

Dr. E. E. Murphey, writing of the bird in the Savannah River Valley of Georgia (1937), states that it prefers moss "whenever it is present" but adds, "contrary to the experience of Arthur T. Wayne in the coastal area, it breeds also in pine woods which at places come very close to the margins of the swamps * * * Here the Yellow-throated Warbler nests not uncommonly, building far out on the end of the horizontal limbs, well concealed by the needles." He states that "two broods are usually reared." W. H. LaPrade, Jr. (1922) describes the nesting in the Atlanta area as similar to that noted by Dr. Murphey about Augusta. In the coastal strip and the offshore islands conditions identical with those in South Carolina prevail.

In the latter State birds are usually mated by March 11. Nest building is begun by the middle of the month unless the season is delayed or adverse weather hinders operations, in which case nests are not found at times until early April. Georgia and Florida nestings correspond closely. In areas where Spanish moss is not found, *dominica* reverts to saddling its nest on the horizontal branches of trees. Pearson and the Brimleys (1942) state that in the Raleigh, N. C., area the nest is frequently constructed in pines "at a height of from 20 to 40 feet." They also say that in the coastal region where the cypress occurs the bird "frequently nests in the long, gray moss hanging from the trees." North Carolina nesting commences in late April.

The nest is constructed mostly by the female, sometimes completely so, but D. J. Nicholson (1929) has seen the male assisting in Florida. In the spring of 1942 a nest was built in a banner of moss no more than 20 feet from the porch of my home, at the extremity of a drooping live-oak limb. The female brought material as often as twice a minute, disappearing completely within the moss clump which could be seen bulging now and then with her movements. She was utterly unconcerned by observers on the porch, even the noise made by children not disturbing her in the least. The male sang constantly nearby.

Two broods are raised in coastal South Carolina. The young of the first are fully fledged by April 22, according to Wayne. The second nest is begun soon after the first brood is away. The yellow-throated warbler will, of course, lay again if accident befalls the nest and eggs. Little time is lost in the interim and illustrative of this tenacity of purpose are some interesting notes of C. S. Brimley (1943) dealing with experiments made by him and his brother, H. H. Brimley of Raleigh, N. C. On April 25, 1890 they collected a set of four eggs from the nest in a pine tree, 42 feet up. Four days later (April 29) another nest was being built in a smaller pine nearby, at an elevation of 47 feet. On May 12 a set of eggs was taken from it and three days later (May 15) the birds again began to build, this time in a very slender pine which had to be stayed with ropes when eggs were removed from the nest on May 26. Two days later the fourth nest was started in a large pine, 44 feet up. On June 7 additional eggs were secured. All sets consisted of four eggs. No further attempts were made on this persevering pair but "they may have built a fifth nest * * * for all we know to the contrary."

Although it seems remarkable that Audubon apparently failed to remark particularly on the moss-nesting habits of this warbler, it will be recalled that his observations seem to have been made largely in Louisiana, for he stresses this State in his account of the species; but he could hardly have failed to observe it elsewhere in the South, particularly on his visits to Rev. John Bachman in Charleston. Of the nest Audubon (1841) says that it is "placed on a horizontal branch of a cypress, twenty, thirty, or even fifty feet above the ground, and is with difficulty discerned from below, as it resembles a knot or a tuft of moss." Certainly, moss is abundant in Louisiana and it would seem that the birds there share this preference despite the fact that the form of this warbler found there is *albilora*.

Eggs.—[AUTHOR'S NOTE: Dr. Chapman (1907) says that the yellow-throated warbler lays 4 or 5 eggs, but very rarely 5, and adds:

"Ground color a dull greenish gray-white, in a large series the peculiar color of the markings seem to tinge the ground color; the markings are very mixed, numerous under shell marks, in the form of blotches and specks, of pale lavender and purplish gray overlaid with heavier surface markings of wine-red, umber and deeper shades of purplish gray and blackish. The heaviest markings are at the larger end, which is sometimes well wreathed, with many spots and specks over rest of egg." The measurements of 50 eggs average 17.1 by 13.0 millimeters; the eggs showing the four extremes measure **19.0** by 13.6, 17.6 by **14.0, 15.4** by 12.7, and 16.0 by **11.9** millimeters.]

Plumages.—[AUTHOR'S NOTE: Dr. Dwight (1900) describes the juvenal plumage, in which the sexes are apparently alike, as "above olive-brown with dull black streaking. Below, dull white, streaked with clove-brown chiefly anteriorly." A postjuvenal molt, beginning early in June in Florida, and involving the contour plumage and the wing coverts but not the rest of the wings or the tail, produces the first winter plumages. These are much like those of the adults, but are generally more brownish, the female being browner than the male. The yellow throat is assumed at this molt.

The first nuptial plumage is acquired by wear, the brownish wash wearing away and the back becoming grayer and the black markings clearer. Young birds are now indistinguishable from adults, except by the browner and more worn wings.

Adults have one complete postnuptial molt in midsummer, after which the fully adult plumage is assumed, the colors of the female being similar to those of the male but duller.]

Food—The food of the yellow-throated warbler has apparently not been well investigated. Little appears in the literature, an illustration of the need to learn more of the diet of small, woodland birds. Records of the examination of seven stomachs reveal that insects compose most of its diet, for according to Howell (1932) "beetles, moths and their larvae, flies, bugs, grasshoppers, grouse locusts, crickets, scale insects, and spiders" are included in the food. Witmer Stone (1937) in writing of the first observance of this warbler at Cape May Point, N. J., on July 13, 1920, states that he saw it take "a green caterpillar about an inch in length." D. J. Nicholson has noted (1929) that while watching one of these birds in Volusia County, Fla., he saw it eat at least ten "worms" in a few minutes as it searched the trees near where he sat.

I have often watched these warblers feeding in my yard and have seen them take small, active caterpillars on numerous occasions. There seems little doubt that scale insects are often taken, as the yellow-throated warbler, creeping about the limbs of trees as it does, undoubtedly finds many of these tiny, but destructive pests. There can be little question as to its benefit to agriculture.

Behavior—There is much that is reminiscent of the brown creeper in the habits of the yellow-throated warbler. Its actions are deliberate and methodical, with none, or very little, of the nervous energy so characteristic of many species of *Dendroica.* As a result it is easier to watch than many other warblers, and its technique of hunting frequently brings it close to the observer. Pearson and the Brimleys (1942) state that it confines its creeping search to the limbs of trees, omitting the trunks altogether. However I have seen this warbler in my yard, feeding on the trunks of both pines and oaks. In this posture, it acts almost exactly like the black-and-white warbler (*Mniotilta varia*) and the brown creeper (*Certhia familiaris*). D. J. Nicholson of Orlando, Fla. (1929), mentions that he has seen them feeding on the "mossy trunks" of trees.

Milton P. Skinner (1928) writes:

> Yellow-throated warblers are gentle and friendly, but are not really socially inclined, either toward other members of their own kind or toward other species. * * * In the trees, their movements are quick, nervous and active, and they are very neat and trim in appearance for they spend much time in preening * * * As usual with warblers, these little birds are skillful insect catchers, and eat house flies, mosquitoes, ants, crickets, beetles and many other varieties of the smaller insects. Once I saw one on an artificial feeding station eating bread crumbs.
>
> These warblers seem even fonder of bathing than most other warblers. They go regularly and often to their baths, and after bathing they spend several minutes carefully preening their feathers.

Voice—The song of the yellow-throated warbler is one of its distinctive characteristics. Completely unlike the thready, insectlike notes of many of its family, it is difficult to describe verbally, and interpretations of it must necessarily vary according to impressions made on human ears. That it is loud, with a definitely ringing character, is agreed upon by all, and in this respect resembles the beautiful song of the prothonotary warbler (*Protonotaria citrea*) another dweller of the cypress lagoons.

R. T. Peterson (1939) says that the song is "slightly suggestive" of those of the indigo bunting (*Passerina cyanea*) and the Louisiana water-thrush (*Seiurus motacilla*), although I had not noticed this resemblance, and describes the notes as "starting with several clear, slurred notes and dropping slightly down the scale." This is true; the preliminary or "clear" notes vary in number from five to eight, and are run together at the end. F. M. Weston (MS.) says that there are "several distinct repetitions of a single note, ending weakly in an anticlimax trill," also a satisfactory description. Rendered into words (always inaccurate and often misleading) it has been written as *ching-ching-ching-chicker-churwee.* F. M. Chapman (1907) remarks that he was familiar with the song for some years before being impressed with its resemblance to that of *S. motacilla*, and follows with the statement that it is not so much the form of the notes themselves "as their wild, ringing, carrying quality which recalls the song of the water-thrush," in which quality a resemblance is readily understandable, and further says that the song has been compared to that of the indigo bunting "not without reason." Howell (1932) simply characterizes it as "loud and attractive," and also compares it with that of the indigo bunting and the water-thrush.

Aretas A. Saunders (MS.) writes: "The song is bright, musical and lively, beginning with high-pitched two-note phrases, sounding something like *cheeka-cheeka-cincha-cincha*, and then dropping down in pitch in a series of rapid notes. It is fairly loud, with a clear ringing quality." This is much the best description I have seen of this highly individual song.

This warbler is an indefatigable songster. From early March through May (about Charleston) it sings almost incessantly, practically from dawn to dusk. Often only seconds intervene between the renditions. As June approaches, the frequency of its singing drops sharply, and by the middle of that month only a very occasional song is heard.

Enemies.—The yellow-throated warbler is open to the various dangers which beset any of the smaller passerine species, but I know of no single enemy that operates against it particularly. However, it occasionally falls into a somewhat novel trap, becoming entangled in tough spider-webs. In much of the cypress country of the southeast the large Carolina silk spider makes its home and spins a magnificent golden web high up amid the straight-trunked columns of the trees. Some of these webs may stretch for many yards and on two occasions I have seen this warbler caught therein. In one instance it was the convulsive fluttering of the bird, apparently stationary in midair, which attracted attention and after some moments of violent activity, it succeeded in breaking the strands which held it. In the other, a dead specimen was found inextricably entangled. Although two experiences such as this are by no means conclusive of any marked mortality, it at least indicates that this may occur more often than one would realize.

Field marks.—The brilliant yellow throat is always diagnostic and is usually readily seen because of the bird's tameness and deliberate actions. The grayness of the plumage is also apparent. A brief glimpse is enough to establish its identity, even if the characteristic song is unfamiliar.

Fall.—The yellow-throated warbler leaves the northern portions of its range rather early. A very late specimen in the northern perimeter of the range was found dead by J. K. Potter (MS.) at Collingwood, N. J., on November 2, 1943. According to H. H. Bailey (1913) departure dates for southeastern Virginia are in the "latter part of July." May T. Cooke (1929) gives the latest occurrence about Washington as September 11, 1927. Near Lynchburg, R. H. Freer (MS.) has seen it once on September 30. These are all considerably later than Bailey's late July, and though very late, dates indicate that the species may remain in Virigina well into August. C. W. Richmond and J. D. Figgins secured specimens on July 28, 1889, at Four Mile Run (near Washington), these being noted by William Rives (1890) in his catalog of Virginia birds.

Late September sees the last migrants leaving central and western North Carolina; the twenty-fifth of that month in the Raleigh area and the twenty-eighth in the Asheville region (Pearson and the Brimleys, 1942). In the coastal area the average is probably a little later.

From South Carolina southward, as already noted, the species is a permanent resident though the scattered wintering individuals are quite probably birds that nested in the northern portion of the range. About Charleston birds can be seen through July and August, but being quiet are not nearly so noticeable, and their numbers fall off in September and October. The young appear to leave much earlier, indeed, shortly after the cessation of the song period in mid-June, though doubtless early July sees some of them still here.

In Florida I have not seen this warbler south of the Lake Okeechobee-Kissimmee Prairie region in winter but occasional individuals are seen there throughout January and February in the "hammocks" and they begin to sing in early March. In the western part of the state F. M. Weston writes from Pensacola that the "fall migration is hardly noticeable in this region, for the birds have been silent and inconspicuous since June, and the migratory movement consists merely of a quiet withdrawal from the area." Of its winter status in that area he follows with the statement that the "yellow-throated warbler winters regularly in small numbers, at which season it is confined to the live oak groves. In order to find it, an observer must scan carefully every chickadee-titmouse group found in situable situations. The composition of such a group would be half-a-dozen each of the tufted titmouse, Florida chickadee, myrtle warbler and ruby-crowned kinglet, a blue-gray gnatcatcher, a blue-headed vireo, an orange-crowned warbler and one or two yellow-throated warblers."

Alexander Wilson (1832) in speaking of the first specimen of this warbler he ever saw (in Georgia) stated that it was late in February and was the first spring appearance of the species in that area, following this at once with the explanation that "they leave the U. S.

about three months during winter and, consequently, go to no great distance." He was in one of his few errors here for the warbler is, as we have abundantly seen, present in southeastern United States through the whole of the winter.

DISTRIBUTION

Range.—Southeastern United States to Panamá and the West Indies.

Breeding range.—The yellow-throated warbler breeds **north** to northern Illinois (Knoxville, Hennepin, Saint Charles, and possibly Waukegan); northern Indiana (Elkhart and Waterloo); northern and eastern Ohio (Wauseon, Sandusky, Cleveland, and Cadiz); northern West Virginia (Doddridge County); northern Maryland (Baltimore); and southern Delaware (Seaford and Frankford). Its occurrence, without indication of breeding has been reported north to Sigourney, Iowa; Lake Koshonong and Racine, Wis.; Kalamazoo, Battle Creek, and Detroit, Mich.; Frankfort Springs and Narberth, Pa.; Mamaroneck, N. Y.; Hartford, Conn.; and Dedham, Mass. **East** to southeastern Delaware (Frankford); and the Atlantic coast to central eastern Florida (Titusville). **South** to south-central and western Florida (Titusville, Bassinger, Punta Rossa, Tarpon Springs, St. Marks, and Pensacola); the Gulf coast of Mississippi and Louisiana to eastern and central Texas (Port Arthur, Houston, Brazoria County, San Antonio, and Ingram). **West** to eastern Texas (Ingram, Austin, Waco, Rhome, and Gainesville); central Oklahoma (Dougherty, Oklahoma City, and Ponca City); southeastern Kansas (Neosha Falls), central Missouri (Columbia); and western Illinois (Knoxville).

The territory as outlined is occupied by two geographic races: the eastern yellow-throated warbler (*D. d. dominica*) breeds from Maryland southward and east of the mountains; the sycamore yellow-throated warbler (*D. d. albilora*) breeds from the mountains westward.

Winter range.—The two races appear not to mingle in winter. The yellow-throated warbler winters **north** to northwestern Florida (Pensacola and St. Marks); and casually to southern Georgia (Thomasville and Brunswick). **East** to southeastern Georgia (Brunswick); the Bahamas (Watling and Great Inagua Islands); Dominican Republic (Samaná); Puerto Rico; and St. Thomas; casually to Montserrat. **South** to Montserrat, casually; Haiti (Port au Prince); and Jamaica. **West** to Jamaica; Grand Cayman; western Cuba (Isle of Pines and Habana); and western Florida (Pensacola).

The sycamore warbler winters regularly **north** to southern Sinaloa (Mazatlán); Nayarit (Tepic); southern Veracruz (Tlacotalpan); Yucatán (Progreso); and Quintana Roo (Cozumel Island). **East** to Quintana Roo (Cozumel Island and Xcopén); British Honduras

(Belize); central northern Honduras (Ruatán Island and Puerto Castilla); southeastern Nicaragua (Greytown); and central Costa Rica (San José and Cartago). **South** to Costa Rica. **West** to western Costa Rica (Cartago); western Guatemala (Dueñas and Totonicopán); western Guerrero (Acapulco); western Michoacán (Coahuayana); Colima (Colima); and southwestern Sinaloa (Mazatlán). It also winters in small numbers in Cameron County, Tex.

Migration.—Late dates of departure from the winter home are: Puerto Rico—Ponce, February 26. Haiti—Île à Vache, April 29. Cuba—Cienfuegos, April 15. Bahamas—New Providence, April 15. Veracruz—Tres Zapotes, March 25.

Early dates of spring arrival are: Alabama—Greensboro, March 10. Georgia—Augusta, March 2. South Carolina—Columbia, March 23. North Carolina—Raleigh, March 13. Virginia—Lawrenceville, March 19. District of Columbia—Washington, March 24.

Late dates of fall departure are: Ohio—Toledo, September 28. Indiana—Bloomington, October 9. Missouri—St. Louis, October 11. Kentucky—Bowling Green, October 5. Tennessee—Nashville, October 3. Arkansas—Helena, October 10. Mississippi—Biloxi, October 12. Louisiana—Monroe, October 16. Texas—Brownsville, October 8. District of Columbia—Washington, September 27. Virginia—Lynchburg, October 6. North Carolina—Chapel Hill, October 6. Georgia—Athens, October 11.

Early dates of fall arrival are: Bahamas—Nassau, July 26 Cuba—Guantánamo, July 11. Jamaica, August 16. Dominican Republic—Monte Viejo, August 26. Puerto Rico—Fortuna, August 28. Mexico—Chiapas, Ocote, August 13. Guatemala—San Lucas, August 7. Honduras—Truxillo, September 26. Costa Rica—San José, September 17.

Casual records.—A number of specimens of the sycamore warbler have been taken on the Atlantic seaboard.

Egg dates.—Florida: 11 records, April 17 to June 9; 7 records, April 20 to 29.

South Carolina: 31 records, April 2 to May 22; 21 records, April 14 to 26, indicating the hight of the season (Harris).

DENDROICA DOMINICA ALBILORA Ridgway

SYCAMORE YELLOW-THROATED WARBLER

PLATE 44

HABITS

This western form of the yellow-throated warbler makes its summer home in the Mississippi Valley, from southern Wisconsin and southern Michigan southward, and it winters in Mexico and Central America.

Although its winter range is so widely separated from that of the eastern form and its summer range, mainly west of the Alleghenies, is quite distinct, the two forms are very much alike in characters and habits. Ridgway (1902) describes it as similar to the yellow-throated warbler, "but with much smaller bill, the superciliary stripe more rarely yellow anteriorly, and with white areas on inner webs of lateral rectrices averaging decidedly larger."

Allison wrote to Dr. Chapman (1907) that in southern Louisiana, "it has a strong liking for woods shrouded in heavy festoons of Spanish moss, and, therefore, keeps much to the cypress swamps; but it is common in the less damp woods in the same regions; on the northern shores of Lake Pontchartrain it spreads slightly from the cypress swamp into the pines. It is essentially a bird of the larger trees, and swampy forest may be considered its typical habitat." M. G. Vaiden, of Rosedale, Miss., tells me that he always looks for the sycamore warbler in the cypresses, and that it is seldom found elsewhere, except on migrations.

Ridgway (1889) says of its haunts in Illinois: "The Sycamore Warbler is a common summer resident in the bottom-lands, where, according to the writer's experience, it lives chiefly in the large sycamore trees along or near water courses." In Indiana, according to A. W. Butler (1898), "the Sycamore Warbler does not depart from the vicinity of streams, even following small creeks, along which sycamores grow, for quite a distance towards their source. They seem to prefer these trees, spending much time among their highest branches, but they may also be found among all the trees fringing waterways, sometimes quite near the ground, and often are seen among our orchards, lawns, and even the shade trees along the streets of towns in the valleys."

It seems to be partial to the large, picturesque, stream-loving sycamores in other parts of its range, as far north and east as Michigan and Ohio, thus deserving its well-chosen name. In many places these fine trees have disappeared, and the warblers have become scare or have gone entirely.

Spring.—The sycamore yellow-throated warbler is one of the earliest wood warblers to enter the United States from its winter home, arriving in Louisiana around the first week in March, reaching Indiana about the middle of April, and appearing in Michigan as early as April 20. In Ohio, according to Dr. Wheaton (1882), "this is the first of the family to arrive in spring. It is always to be seen before the Yellow-rumped and Yellow Warblers make their appearance, sometimes before the last snow and ice. I have seen them in considerable numbers on the 13th of April, and have known of its occurrence as early as April 9th. When on their migrations they confine themselves almost exclusively to the trees which skirt the streams, and move northward by day with considerable rapidity."

The main migration route seems to be almost directly northeastward, from western México and Central America to western North Carolina and Ohio, and more directly northward through the broad Mississippi Valley to Michigan and Wisconsin. This is markedly different from the migration route of the eastern race, which migrates nearly northward along the Atlantic coast.

Nesting.—Whether the nest of the sycamore warbler is in a cypress or in a sycamore, it is always placed at a considerable height from the ground, for this is a treetop bird. Nests have been recorded at heights ranging from 10 to 120 feet above the ground, but probably most of them are between 30 and 60 feet up. Mr. Butler (1928) describes two Indiana nests of similar construction. One was—

> built about 35 or 40 feet above the ground in a flat crotch, on an approximately horizontal limb of a large sycamore tree. * * * The nest measures as follows: Outside diameter 2.50 inches; inside diameter 1.65; outside height 2 inches; inside depth 1.75 inches. The heavier frame was composed of shreds of grapevine bark, bits of the covering and coarser fibre of weeds, mingled with which were many small pieces of cotton cord or ravelings. The nest was lined and its entire bottom was composed of the soft down obtained from dry sycamore balls. In fact the nest really had no foundation for the bottom, the lining material reaching through to the limb. [The other] was about 75 feet above the ground in a crotch of small branches toward the end of a sycamore limb which was not strong enough to bear one's weight. It was so hidden by the foliage that it could not be seen until some of the leaves fell this autumn.

A set of four eggs is in the Richard C. Harlow collection, taken by W. C. Avery, Greensboro, Ala., April 24, 1893. The nest was in a liquidambar tree, 26 feet up and 9 feet out from the body of the tree, on a horizontal branch and nearly concealed in the *Tillandsia* in which it was built. George Finlay Simmons (1925) says that in Texas the nests are sometimes built in an elm or a pecan tree, from 12 to 35 feet from the ground.

Eggs.—The sycamore warbler lays from 3 to 5 eggs; in most cases 4 eggs seem to complete the set. Mr. Simmons (1925) describes them as "dull greenish gray-white; marked with distinct and clouded blotches, specks, and under-shell markings of lavender, purplish-gray, umber, and brownish-red; and sometimes even blackish spots; usually wreathed about the larger end." The measurements of 10 eggs average 16.9 by 12.7 millimeters; the eggs showing the four extremes measure **17.6** by **12.1**, **16.2** by 12.8, and 16.6 by **13.0** millimeters.

Plumages.—The sequence of plumages and molts is probably the same as for the yellow-throated warbler.

Food.—Very little seems to have been published on the food of this warbler, but it probably does not differ materially from that of the other wood warblers. Professor Aughey (1878) found remains of 15 locusts and 24 other insects in the stomach of one collected in Nebraska. A. H. Howell (1924) says: "Examination of 9 stomachs of this bird from Alabama showed its food to be mainly flies, beetles, ants and other Hymenoptera, and spiders."

Behavior.—Ridgway (1889) says that "in its motions, this warbler partakes much of the character of a creeper, often ascending or descending trunks of trees or following their branches, much in the manner of a *Mniotilta*." Butler (1898) says that "its longer flights much resemble those of the Chipping Sparrow. Its shorter ones, as with quivering wings it beats rapid strokes when moving from limb to limb, remind one of the movements of the Kingbird." Referring to its general habits in Texas, Simmons (1925) says it is—

> observed singly or in pairs, moving very slowly about in the tops of the trees, particularly the sycamores along streams, carefully keeping limbs and branches between itself and any chance observer. Movements very deliberate, sometimes stopping for several minues, *creeping* along by small hops, among upper branches, never on trunks or larger limbs; thus, in actions, strikingly different from most members of the warbler family. Usually keeps to the tops of the tallest trees; hops from one perch to another very slowly; occasionally comes down among the lower branches. Usually quiet, the song being uttered at wide intervals; however, at times in spring it may be heard almost constantly singing.

Voice.—Butler (1898) writes: "The song of the Sycamore Warbler, as I catch it, is as follows: *Twit, che-e, che-e, che-e, che-e, che-e, che-á.* This is about its usual length. The first syllable is abrupt, with rising inflection, then, after a slight pause, the remainder is uttered at the same pitch until the last syllable, which ends sharply with a slight rise in tone. The whole song is very unique. Its notes are clear and distinct, and it is pitched in such a key that it may be heard under favorable circumstances over a quarter of a mile."

Mr. Allison wrote to Dr. Chapman (1907) as follows: "The call-note is a rather lively chipping, like that of an agitated Parula Warbler, or perhaps somewhat more like that of Pine Warbler. The song is like the Indigo Bunting's, much softened, and with a falling cadence all the way through; thus: *See-wee, see-wee, see-wee, swee, swee, swee, swee*—the last four notes uttered more rapidly, but becoming fainter, until the last one is very indistinct."

Mrs. Nice (1931) writes: "The songs of this lovely warbler made one think of evergreen forests; they gave a wistful, haunting touch to the somber, leafless woods, where most of the bird notes were loud and ringing. The bird in the Oliver's woods in 1927 had two songs. 'A' was in a continuously descending scale except for the last note which was slightly higher than that preceding—*see see see see see see chérwer;* the ending was abrupt. 'B' was more musical; it consisted of four notes on the same pitch, then three descending, ending with one on a somewhat higher pitch. Both songs were given five and six times a minute."

Winter.—Dr. Skutch contributes the following note: "The sycamore warbler is a rare winter resident in Central America, infrequently recorded in both the highlands and the Caribbean lowlands. Although Griscom states that in Guatemala it is a common winter visitant, the statement scarcely seems supported by the paucity of published records. Carriker knew of but one specimen taken in Costa Rica. I have myself seen this bird only thrice during 12 years in Central America. On January 22, 1935, I found one in a flock of Townsend's and black-throated green warblers in the pine woods on the Finca Mocá, on the Pacific slope of Guatemala at 3,500 feet. My one Honduran record is of a bird seen among the coconut trees by the shore at Puerto Castilla, on January 27, 1931. Peters secured a single specimen from a coconut palm near Tela, in the same general region, on January 18, 1928. In Costa Rica, I found one of these rare warblers in the garden of the hacienda Las Cóncavas, near Cartago, at 4,600 feet above sea-level, on November 3, 1935.

"Griscom's record of the sycamore warbler at San Lucas, Guatemala, on August 7, indicates early arrival. The single published Costa Rican date is of a bird collected by Underwood at San José on September 17. The date of the spring departure appears to be quite unknown."

DENDROICA GRACIAE GRACIAE Baird

NORTHERN GRACE'S WARBLER

HABITS

This pretty little warbler was discovered by Dr. Elliott Coues (1878) and named by him in honor of his sister and for whom, as he expresses it, "my affection and respect keep pace with my appreciation of true loveliness of character." Of its discovery, he states: "While journeying through New Mexico, *en route* to Fort Whipple, Arizona, in July, 1864, I found Grace's Warbler on the summit of Whipple's Pass of the Rocky Mountains, not far from the old site of Fort Wingate, and secured the first specimen on the second of the month just named." He afterwards found it to be "the most abundant bird of its kind, excepting Audubon's Warbler," in the pine forests on the mountains of Arizona, and says that Henshaw found it to be "one of the commonest of the summer Warblers in the White Mountains. * * * His observations confirm my own in regard to the pine-loving character of the birds; he found them almost invariably in coniferous forests, passing swiftly along the smaller branches of these tall trees, or darting into the air to capture passing insects; and even in August, when various families had united into small flocks, and were lingering in company with other insectivorous birds, before their departure for the South, their preference for their native pines was still evident."

I found it fairly common in the upper reaches of Ramsey Canyon in the Huachuca Mountains of Arizona, among the tall, scattered yellow pines, at elevations between 6,000 and 7,000 feet, where a nest with young was found on June 4, 1922. Swarth (1904) found it more common there as a migrant than as a breeding bird and rather irregular in its abundance.

Grace's warbler, now well-known as a summer resident in the mountains of southern Colorado, New Mexico, Arizona, Sonora, and Chihuahua, is apparently closely related to the yellow-throated warbler of the southern States and to Adelaide's warbler of Puerto Rico; it has a slightly differentiated subspecies in Central America.

Nesting.—What is probably the first authentic nest of Grace's warbler to be reported was taken in Yavapai County, Ariz., on June 23, 1890, by H. Keays for H. P. Attwater. This nest is described by Samuel B. Ladd (1891) as "placed on limb of pine sixty feet from the ground. Nest very compact; outside diameter 3 in. by 1½ in. high; inside diameter 1¾ in. by 1¼ in. deep. The body of this nest is composed of horse-hair, strings and vegetable fibres. The most abundant vegetable material interwoven consists of the staminate catkins and bud scales of *Quercus emoryi.* There is also some wool, vegetable down, and insect webbing, in which are entangled the exuviae of some caterpiller. Attached on the outside was a small staminate cone of a species of *Pinus.* Nest well lined with feathers and horse-hair."

O. W. Howard (1899) found two nests in Arizona; one nest was "placed deep down in the middle in a large bunch of pine needles and was entirely hidden from view." The other he found "in a red fir tree. It was placed in a thick bunch of leaves at the extremity of a limb about fifty feet from the ground." A nest with four eggs, in the Doe Museum in Gainesville, Fla., taken by O. C. Poling on May 25, 1891, at 8,000 feet in the Huachuca Mountains, was built in a bunch of pine needles and cones at the end of a long branch of a red pine, 20 feet from the ground.

Eggs.—From 3 to 4 eggs, apparently more often 3, make up the set for Grace's warbler. They are ovate with a tendency toward elongate ovate, and are only slightly glossy. They are white or creamy white, finely speckled and spotted with "auburn," "bay," or "chestnut brown," intermingled with "light brownish drab," "deep brownish drab," or "pale vinaceous drab." The markings are concentrated at the large end, where they frequently form a distinct wreath, leaving the lower half of the egg immaculate. Occasionally eggs are speckled all over; and some are marked with blotches. Generally the drab spots are in the majority, when the fewer brown spots, which are often as dark as to appear almost black, are more prominent. The measurements of 38 eggs average 16.9 by 12.7 millimeters; the eggs showing the four extremes measure **18.2** by 13.1, 18.0 by **13.3, 14.8** by 12.7, and 15.4 by **11.7** millimeters (Harris).

Young.—Nothing seems to have been published on incubation or on the development and care of the young.

Plumages.—Ridgway (1902) describes the young male in first plumage as "above plain grayish hair brown or drab-gray, the feathers ash gray beneath the surface; sides of head similar but rather paler; malar region, chin, and throat pale brownish gray, minutely and sparsely flecked with darker, the chest similar, but with rather large roundish spots of dusky; rest of under parts dull white streaked or spotted with dusky gray medially, dull grayish laterally."

Swarth (1904) writes of the postjuvenal molt:

> A young male taken July 13th is in the brown streaked plumage, but yellow feathers are beginning to appear along the median line of the throat and upper breast, and the yellow superciliary stripe is also beginning to show. Another, a little older, has the streaks of the lower parts restricted to the sides and flanks, and the yellow markings nearly perfect. A male taken on July 30th, which has just discarded the juvenile for the winter plumage, differs from the autumnal adults in having the white of the under parts more strongly tinged with buff; and whereas the adult has the back decidedly streaked, though the markings are overcast by the brownish edgings to the feathers, in the juvenile these markings are but imperfectly indicated.

Apparently, the nuptial plumage is assumed by wear alone, for no available specimens show any signs of prenuptial molt and both young birds and adults in the fall are much like the spring birds, but browner and with the markings obscured by brownish tips that probably wear away before spring.

Young birds and females have duller colors than the adult males and are browner in the fall than in the spring. Adults doubtless have a complete postnuptial molt in late summer.

Behavior.—Grace's warbler is a bird of the pines, spending most of its time in the towering tops of the tallest trees. It is sometimes seen in other conifers such as hemlocks and spruces, but very seldom on or even near the ground. Dr. Wetmore (1920) says: "Usually they were found in the tops of the Yellow Pines where they worked about rather leisurely, exploring the smaller limbs and at short intervals pausing to sing. * * * Occasionally one was found working about through the oak undergrowth at times coming down almost to the ground. The flight was undulating and rather quick and jerky."

Dr. Coues (1878) writes: "They are seen coursing among the branchlets, skipping at apparent random through the endless intracacies of the foliage, hovering momentarily about the terminal bunches of needles, and then dashing far out into clear space, to capture the passing insect with a dexterous twist and turn. So the season passes, till the young are on wing, when the different families, still with bonds unbroken, ramble at leisure through the woods, the young birds timid and feeble at first, venturing shorter flights than their parents, who seem absorbed in solicitude for their welfare, and attend them most sedulously, till they are quite able to shift for themselves."

We found Grace's warbler to be an active, restless species. We could often locate one by its song coming from lofty top of some tall pine, but before we could see its diminutive form, we would hear its song coming from some distant tree farther up the mountain side; and so we would follow the little songster from tree to tree, seldom getting more than a fleeting glimpse of it. At times, however, when it was more interested in feeding than in singing, we could see it quietly gleaning its insect food along the smaller branches and twigs after the manner of the pine warbler. We never saw it on or near the ground.

Voice.—Dr. Wetmore (1920) says that the song of Grace's warbler, as heard by him at Lake Burford, N. Mex., "was a rapid repetition of notes somewhat reminiscent of the efforts of the Chipping Sparrow, but with the notes evenly spaced, not blurred at the end, and closing abruptly, so that the last syllable was as strongly accented as any of the others. It resembled the syllables *chip chip chip chip chip* given in a loud tone."

Dr. Walter P. Taylor has sent me some notes on the song, which he calls "rather a modest utterance conspicuously lacking in strength. Song, *tseet tseet tseet tseet zeekle zeet.* A better rendering is *tsew tsew tsew tsew tsew tsee tsee tsee tsee tseeeip!* The song has something of a yellow warbler quality. I find it extremely hard to put down on paper anything that remotely resembles it." Again he writes it "*tchew tchew tchew*, more slowly uttered, followed by *tsip tsip tsip tsip tsip*, rapidly repeated."

Field marks.—Grace's is one of the smallest of our wood warblers, a tiny bird. It shows a striking resemblance to the yellow-throated warbler, but it is much smaller, has no black in the cheeks, and it has a yellow rather than a white mark below the eye. The adult male in spring is light bluish gray above, marked on the head and back with black spots, with a bright yellow throat, two white wing bars, and much white in the tail. Females, young birds, and males in the fall are similar but browner.

DISTRIBUTION

Range.—Southwestern United States to central Mexico.

Breeding range.—Grace's warbler breeds **north** to southern Utah (Zion National Park); southwestern Colorado (Fort Lewis and Pagosa Springs); and central northern New Mexico (Tres Piedras; possibly Sierra Grande). **East** to central New Mexico (Tres Piedras and Mesa Yegua); western Texas (Guadalupe Mountains); and northwestern Chihuahua (Colonia García). **South** to northwestern Chihuahua (Colonia García) and southeastern Sonora (Rancho Santa Bárbara). **West** to western Sonora (Rancho Santa Bárbara, Moctezuma, and Nogales); eastern central and western Arizona (Huachuca Mountains, Tucson, Fort Whipple, Hualpai Mountains, and Mount Trumble); and southwestern Utah (Zion National Park).

Winter range.—In winter Grace's warbler seems to be confined to a small area in central western Mexico, from central Jalisco (Bolaños) southeast to east central Michoacán (Patambán and Patzcuaro); and west to south central Jalisco (Zapotitlán); occasional north to northern Nayarit (Santa Teresa).

Migration.—Very little information is available regarding the migratory movements of Grace's warbler. Dates of spring arrival are: Sonora—Mina Abundancia, April 11. New Mexico—Silver City, April 20. Arizona—Santa Rita Mountains, March 15. The latest date of one recorded at Albuquerque, New Mexico, is September 7. A resident race occurs in Central America.

Egg dates.—Arizona: 9 records, May 3 to June 27; 5 records, May 30 to June 8, indicating the height of the season.

New Mexico: 2 records, May 22 and June 13 (Harris).

DENDROICA PENSYLVANICA (Linnaeus)

CHESTNUT-SIDED WARBLER

PLATES, 45, 46

HABITS

Many changes have taken place in the distribution and relative abundance of many birds in different parts of our land since the settlement of the country, owing to the changes wrought in the landscape by man. The beautiful little chestnut-sided warbler is one of the species that has benefited, flourished, and increased with the spread of civilization. It seems strange that such a common, well-marked, and familiar species, as we now know it to be over so much of northeastern North America, should have been largely unknown by the early writers on American birds. Edward H. Forbush (1929) tells the story very well as follows:

> Audubon met with it but once; Wilson saw little of it; Nuttall, who considered it rare, evidently knew little about it, and saw very few. Since his time, however, its numbers have increased until it has become one of the commonest of eastern warblers. Its increase was favored by the destruction of the primeval forest and the continued cutting away of subsequent growths, and later by the increase of neglected fields and pastures with their growths of bushes and brambles, for it is not a frequenter of deep woods, nor yet of well-kept gardens, orchards or farmyards, but prefers neglected or cut-over lands, with a profusion of thickets and briers. So we may find it usually away from houses, in low roadside and brookside thickets, or in sproutlands rather recently cut over. As the coppice grows up the bird retires to other quarters or to the edges of the woods.

According to William Brewster (1906), the chestnut-sided warbler began to appear in the Cambridge region in about 1830 or 1831, when Nuttall began to find it, but he writes: "Dr. Samuel Cabot told me a year or two before his death that when he was at Harvard College (1832–1836) the Chestnut-sided Warbler was certainly very rare in eastern Massachusetts, and that for some years later it was not common although it gradually but steadily increased in numbers after 1835." A similar increase in numbers has been noted in other places. Dr. Chapman (1907) says: "In my own experience, covering the past twenty-five years, at Englewood, N. J., I have seen this Warbler become established as an increasingly common summer resident." And A. Radclyffe Dugmore (1902) writes, in reference to the same general region: "In the summer of 1897, the first year that I did any systematic bird work in this locality, these birds were so little in evidence that I did not observe a single specimen." During the next two years a few pairs were discovered in suitable clearings, but "in 1900 the Warblers were comparatively common, every clearing containing several pairs, and last summer they were still more abundant, four pairs occupying a clearing of only a few acres, while in the large clearing there were more than could be counted with accuracy; probably not less than seven or eight pairs."

The breeding range of the chestnut-sided warbler is now known to extend from central Saskatchewan and Newfoundland on the north throughout southern Canada and the northern half of the United States east of the great plains; but it is much commoner in the States than in Canada, and its breeding range extends farther south in the Alleghenies, to northern Georgia. Writing of the birds of the central Allegheny Mountains, Prof. Maurice Brooks (1940) calls it "one of the most abundant warblers in mountainous cut-over areas. It is a characteristic bird of the 'chestnut sprout' association, and reaches the edges of the spruce forests. In northern West Virginia it breeds down to 1200 feet, and it occurs up to 4800 feet where the habitat is suitable. Mountain laurel thickets offer a favorite nesting place, and dead chestnut trees are often used as singing places." Referring to northeastern Georgia, Thomas D. Burleigh (1927a) writes: "I have noted a few singing males as low as 3500 feet, but it is only above an elevation of 4000 feet that these birds occur in any numbers. Within a few hundred yards of the top of Brasstown Bald the south slope is covered with small stunted oaks that are few enough in number to encourage a thick undergrowth of laurel and huckleberry bushes. In this limited area the Chestnut-sided Warblers are actually plentiful, and are among the few birds that can be found breeding there."

Spring.—According to Dr. Chapman (1907), "the Chestnut-sided Warbler passes through eastern Mexico and the Gulf States from northwestern Florida to eastern Texas. It is casual in southern Florida and the Bahamas."

M. A. Frazar (1881) saw "quite a number" migrating across the Gulf of Mexico, when his ship was about 30 miles south of the Mississippi delta. In the great wave of migrating warblers and other small birds that I saw on the islands in Galveston Bay, Texas, on May 4, 1923, chestnut-sided warblers were much in evidence, as they generally are in all of these transient hosts; here they were buffeted about by a northerly gale and were seeking shelter behind every little eminence or clump of bushes, to rest before struggling again against the wind.

The spring migration along the eastern route seems to be mainly along the Allegheny Mountains, or near them. E. S. Dingle tells me that he has but one record for coastal or southern South Carolina, April 24, 1929; and Arthur T. Wayne (1910) does not include it in the birds of that State.

According to Dr. Chapman's (1907) data, nearly a month (25 days, to be exact) elapses between the average dates of arrival at Atlanta, Ga., and arrival at Scotch Lake, New Brunswick. And on the interior route it seems to take just a month for the birds to travel from southern Texas to Aweme, Manitoba.

Nesting.—My local experience with the nesting of the chestnut-sided warbler dates back to the old "ministerial road" in Rehoboth, Mass., a typical locality in which to find the nests of this warbler. This narrow, neglected, country road skirted the border of the village cemetery, with an open field on the other side, while between the stone wall that bordered the field and the road was a long narrow strip of very small trees and underbrush, mainly hazel bushes. Along the quarter-mile stretch of this road we could always count on finding several pairs of this warbler nesting in the hazel bushes, generally at heights of 2 or 3 feet in the thickets of small bushes; one nest was as low as 14 and one only 18 inches above the ground. We found numerous nests elsewhere along the edges of country roads, in old neglected pastures, in sproutlands, and about the borders of woodlands, where there was suitable shrubbery. Fully 90 percent of the nests were in hazels, but occasional ones were found in huckleberry bushes, blackberry tangles, hardhacks, or small saplings.

Most of the nests are flimsy affairs and loosely built, the walls so thin that daylight shows through them in one or more places; but some are fairly compactly woven. Four nests before me vary considerably in size and construction. The smallest and most compact measures about 2¼ by 2½ inches in outside diameter, is about 2 inches high externally, and the inner cavity is about 1¾ wide and 1¾ inches deep. The largest nest measures 3½ by 4 inches in outside diameter, but has about the same height and inside dimensions as the smallest nest and differs from the others in having the whole upper part, or nest proper, made entirely of the finest grasses and extremely fine reddish brown fibers built on a foundation of the usual materials. The other nests are intermediate in size and shape, and are made of both coarse and fine strips of inner bark from cedars or grapevines, weed stems shredded finely, fine grasses, other plant fibers, and some little pieces of plant down; they are lined with very fine grasses, and sometimes also with a little horsehair or cowhair.

I saw two nests in the woods near Asquam Lake, N. H., where the black-throated blue warblers were breeding (a location described under that species) ; one of these was built in a mountain laurel bush after the manner of the black-throated blue, and the other was in a crotch in a bunch of maple sprouts in an open clearing. The nests found by Mr. Burleigh (1927a) in northeastern Georgia were all "within two feet of the ground, two being in laurels and one in a huckleberry bush." Some observers have referred to the nests of the chestnut-sided warbler as being firmly, compactly, or strongly built, but my experience usually agrees with that of Mr. Burleigh, who says: "The nests were alike in construction, and distinct enough not to be confused with those of any other species found here, being loosely and somewhat shabbily built." Nests have been reported by others as located in hazel, huckleberry, raspberry, blackberry, blueberry, barberry, viburnum, spirea, rhododendron, and azalea bushes, and in saplings of oak, maple, birch, beech, and hornbeam. Probably many others might be added to the list.

Mr. Forbush (1929) gives the following account of nest-building, as observed by F. H. Mosher:

> The female did all the actual work. She laid straws and plant fibers in a fork of an arrow-wood bush, then went to a tent caterpillar colony and tearing off some of the web bound the forking branches about with it, thus tying them together and forming a deep cup-like framework for the habitation; she also bound the foundation firmly in place with more of the same web, then brought

dried grasses or straws and placed them around to form the sides of the nest and bound them to the branches with more caterpillars' webs. Having finished the sides, she put in a lining of soft grasses, fine rootlets and plant fibers. This nest when completed at the end of five days was much less bulky than the usual nest of the Yellow Warbler, and much firmer, with walls not more than one-fourth as thick.

Eggs.—Four eggs seem to form the usual set for the chestnut-sided warbler, but this sometimes consists of only three, or more rarely five. The eggs are ovate, sometimes tending toward elongate ovate, and they have only a slight lustre. The ground color may be white, creamy white, or very pale greenish white. They are speckled, spotted, and blotched with "auburn," "bay," "Brussels brown," "raw umber," "chestnut-brown," "cinnamon-brown," "mummy brown," or "Mars brown," with undertones of "dark brownish drab," "pale brownish drab," or "light purplish drab." The color and amount of the markings vary considerably, ranging from eggs that are delicately spotted, or speckled only with drab colors, to those boldly blotched with browns that form a solid ring around the large end, completely covering the undertones. On some the spots are scattered over the entire surface, but generally they are concentrated and tend to form a wreath. A few eggs have the spots confined to a tight, narrow ring, leaving the rest of the surface almost immaculate. The measurements of 50 eggs average 16.7 by 12.4 millimeters; the eggs showing the four extremes measure **18.0** by 12.5, 17.3 by **13.2,** and **15.2** by **11.7** millimeters (Harris).

Young.—The period of incubation for the chestnut-sided warbler seems to be between 12 and 13 days; Frank L. Burns (1915b) says 10 to 11 days, but this seems in error. Only the female incubates. The young remain in the nest 10 to 12 days. Cordelia J. Stanwood MS. says in her notes: "The young come from the eggs blind and limp, covered with short, fine, sparse down and scarcely larger than bumblebees. About the close of the second day, or the beginning of the third day, they commence to open their eyes and the feather spaces begin to show as dark, swollen tracts. Near the end of the sixth day, not far from the beginning of the seventh, the quill stage ends, and the tips of the feathers show beyond the quill casings. By the eighth day the young are pretty well feathered out, and can leave the nest successfully, but, if undisturbed, they usually remain in the nest until the tenth or the eleventh day. While in the nest the young preen, stretch, yawn, beg for food, and utter various calls. Both the parent birds feed the little ones and cleanse the young of parasites and other vermin, although I have noticed in many cases that the female bird generally seems to be the one that burows under the nestlings and cleanses them and the nest lining of annoying pests. * * * All these warblers that I have watched caring for the young in the early stages of nest life begin by feeding the little ones by regurgitation. At the same time an occasional moth or caterpillar that is crushed and mixed with digestive juices is fed directly. At first smaller and softer insects are doled out; later, larger and tougher moths, caterpillars, crane-flies, and the like are fed to them." Her notes show that the young were fed at frequent intervals, often only one minute apart; sometimes the intervals between feedings were from 5 to 8 minutes, and occasionally as much as 12 minutes.

The parent birds become quite excited when a nest with young is approached, and are sometimes quite bold in their defense of their young; A. D. Du Bois tells me of one that flew at his face, coming within two feet of it as he followed the escaping young; and both parents kept near him, chirping and fluttering.

Plumages.—Dr. Dwight (1900) describes the juvenal plumage, in which the sexes are alike, as "above, dark raw umber-brown, obscurely streaked on the back with dull black. Wings and tail dull black, chiefly edged with ashy or plumbeous gray; the secondaries, and tertiaries with olive-yellow, the coverts with buff forming two wing bands yellow-tinged. Below, pale umber-brown, grayer on the throat and sides of head, the abdomen and crissum dull white."

The first winter plumage, in which the sexes begin to differentiate, is acquired by a partial postnuptial molt, beginning late in June and involving the contour plumage and the wing coverts, but not the rest of the wings or the tail. Dr. Dwight (1900) describes the young male in this plumage as "above, bright olive-yellow concealing black spots on the back and rump, the upper tail coverts black, tipped with cinereous gray and olive-yellow. The wing coverts black, edged with olive-yellow, two broad wing bands canary-yellow mixed with white. Below, grayish white, pearl-gray on sides of head, throat, breast and flanks, a trace of chestnut striping the flanks terminating in a lemon-yellow spot. Conspicuous white orbital ring." The young female is similar, but the white below is duller, the sides are grayer, and the chestnut stripes are lacking.

The first nuptial plumage is acquired by a partial prenuptial molt in late winter or early spring, that involves most of the contour plumage and the wing coverts, but not the rest of the wings or the tail. Young and old birds are now indistinguishable, except for the browner wings and tail of the young bird. The colors of the female are duller and less intense than those of the male in this and in subsequent plumages.

Subsequent molts consist of a complete postnuptial molt in July and August, and a partial prenuptial molt as in the young bird. Adult females in the fall have some chestnut on the sides, but not so much as the males.

Food.—The chestnut-sided warbler is almost wholly insectivorous, though it has been known to eat a few seeds or berries when hard-pressed for food. Its foraging range is between the ground and the tops of small trees, or in the lower branches of some of the larger trees; but mainly it gleans through the foliage of shrubbery or low plants, seldom seeking its food on the ground.

The insects mentioned under the food of the young are all doubtless eaten regularly by the adults; when securing tent caterpillar webs in nest building, it probably does not object to eating a few of the smaller caterpillars but the large, hairy ones may be refused. Spiders are eaten to some extent. No very comprehensive study of the food seems to have been made, but Forbush (1907) makes this general statement: "The food of the Chestnut-sided Warbler is such that the bird must be exceedingly useful in woodland and shrubbery, and in orchard and shade trees as well, whenever it frequents them. It is probable that at times it destroys considerable numbers of parasitic hymenoptera, as it is rather expert as a flycatcher; but it is very destructive to many injurious beetles and caterpillars, being one of the most active consumers of leaf-eating insects. Small borers or bark beetles, plant bugs and plant lice, leaf hoppers, ants, and aphids are eaten."

Professor Aughey (1878) reports that a stomach examined in Nebraska contained 17 locusts and 21 other insects. F. H. King (1883), reporting for Wisconsin, mentions one eating a small grasshopper and canker worms that were feeding on oaks, hazel, hickory, plum, cherry, apple, pear, and currant. Du Bois tells me of one he watched gleaning its food in an elm tree: "In order to secure insects from the under side of an elm leaf, he hovered like a hummingbird at a flower, and thus picked the food from the leaf while poised in the air." Forbush (Chapman, 1907) writes:

> A Chestnut-sided Warbler was seen to capture and eat, in fourteen minutes, twenty-two gipsy caterpillars, that were positively identified, and other insects that could not be seen plainly were taken during that time. * * * A Chestnut-sided Warbler took twenty-eight browntail caterpillars in about twelve minutes. When we consider that the short hairs on the posterior parts of this caterpillar are barbed like the quills of a porcupine and will penetrate the human skin, causing excessive irritation and painful eruptions, we may well wonder if the little bird lived to repeat this performance. But many small birds eat these caterpillars at a time when probably the noxious hairs have not fully developed, and others seem to have learned to divest the larger caterpillars of their hairs by beating and shaking their prey and thus loosening the hairs, which are shed as the porcupine sheds its quills. The insect is then eaten with impunity and even fed to the young birds.

Audubon (1841) tells us that five chestnut-sided warblers, taken during a light fall of snow in May, had eaten nothing but grass seed and spiders.

Behavior.—The chestnut-sided warbler is one of the prettiest of the wood warblers, some regarding it as quite the prettiest. It is certainly one of the most attractive, as it flits about in the roadside shrubbery near us, with its tail elevated, its wings drooping, and its pure white breast swelling as if with pride in its beauty. It is a sprightly, active little bird and far from timid, allowing a near approach as it busily gleans among the foliage or darts out to seize some flying insect. On its nest, which is usually well screened among the leaves, it will sit quietly, confident of its concealing coloration, until we can almost touch it; then suddenly it is gone, out of sight under the bushes; but it soon appears again, nervously flitting about in the taller bushes or trees to scold at our intrusion.

The following note on the behavior of the parent birds at the nest is contributed by Dr. Alexander F. Skutch: "Following the parents as they carried food, I found a nest of the chestnut-sided warbler situated 3 feet above the ground in the midst of a clump of *Cornus racemosa* on a scrubby hillside near Ithaca, N. Y. It contained two half-grown cowbird nestlings, which squealed a little as I took them in hand, and drove the poor, misguided foster-parents to frenzied efforts to entice me from the nest. The male warbler fluttered from twig to twig in front of me, vibrating his wings and spreading his tail; while his mate descended to the ground beneath the dogwood clump, where she crouched on the dead leaves with vibrating wings and spread tail, moving forward slowly and lamely, after the usual manner of distressed parents. I squatted down in the midst of the bushes the better to see her; and the male, becoming uncommonly bold and loudly chirping his protests, displayed so close before me that every most delicate marking of his plumage was visible: The golden crown, the white sides of the head, the rich chestnut bands along the flanks and sides, and every streak of black and white and gray on the wings and back and tail. I might have reached forward and touched him, had he only remained still. On the following day, the performance was repeated for my benefit."

Voice.—Aretas A. Saunders contributes the following full account of the songs of this warbler: "The chestnut-sided warbler is one that has two different songs, which show seasonal differences, so that they may be referred to as territory and nesting songs. The territory song is the first to be heard, during migration and upon the first arrival on the nesting grounds, while the nesting song is not commonly heard until nesting is established. During the nesting period both songs are to be heard. In common with other species that have two songs, the territory song is fairly definite in form but the nesting song is exceedingly variable. Both have the same quality; they are quite loud, of musical quality, but rather chatterlike and not especially sweet, nor are they so pleasing as those of other musical warblers of this genus.

"The territory song consists of 4 to 9 notes on a medium pitch, usually rhythmic and of even length, followed by a louder, high-pitched, strongly accented note, and then by a lower terminal note. This is the song commonly translated as *very, very, pleased to meetcha.* In all but 3 of 30 records of this song the beginning notes are 4, 5, or 6 in number. In 20 records the first notes are single notes, and in the other 10 they are 2-note phrases. This song is always rather short, varying from 1⅖ to 1⅘ seconds.

"The nesting song is so variable that it is difficult to say about it much that is definite. Some notes, near the end of the song, are usually high-pitched and strongly accented, but there are numerous exceptions to this. Of 41 records, 19 are composed wholly or mainly of slurred notes, while 21 are single notes or 2-note phrases in a loud, rapid chatter. In the slurred songs the notes are run together. In some records the notes are continuous throughout, without a pause. In the non-slurred songs the notes are distinctly separate. The nesting song is somewhat longer than the territory song, varying from 1⅗ to 2⅘ seconds.

"The pitch of both songs is about the same, varying from E‴ to A⁗, a range of two and a half tones more than an octave but about an octave lower than that of such species as the blackpoll and the Blackburnian. The song is to be heard from the arrival of the bird in migration till the midle of July. The average date of the last song in Allegany State Park, in 14 years of observation, is July 17. The earliest is July 12, 1931, and the latest July 24, 1927."

Albert R. Brand (1938) gives the approximate mean number of vibrations per second in the song of the chestnut-sided warbler as 5,125, with the highest having 8,775 and the lowest 3,100 vibrations per second. This compares with a mean of 8,900 for the black-poll warbler and 8,600 for the grasshopper sparrow, or an average of 4,000 for passerine songs in general. Francis H. Allen tells me he once found one "with a song consisting of a hurried repetition of a single note as *wit-wit-wit-wit-wit-wit-wit-wit.* Sometimes this was followed by the characteristic warble of the weaker song, and only with this addition was the song recognizable as that of the chestnut-sided warbler. The call note of the species is a thick *chip* with an *L* in it." Miss Stanwood (MS.) writes the song as "*wee-wee-wee-wee-chi-tee-wee.*"

It seems to me that the rhythm of the ordinary song can be well expressed in human words, or catch phrases; for instance, to Sidney E. Ingraham (1938) it sounded like: "*I wish, I wish, I wish to see Miss Beecher!* except that we should normally need three or four seconds to say it, whereas Miss Beecher's lively little friend takes scarcely more than one second. The song is much more like an emphatic sentence made up of words than it is like a phrase of abstract music. The rhythm, of course, is very familiar, actually that of iambic blank verse, rising with force and intention to a climax. Harmonious intervals are lacking, but there are complex inflections ending with the characteristic, explosive little slur up and down." Other catch phrases seem to call the song to mind quite vividly, are *very, very glad to meet you* (Hoffmann, 1904), or Ralph B. Simpson's (Todd, 1940) *dis-dis-dis-dismiss-you*, both with a strong accent on the penultimate syllable. This is, of course, the easiest song to recognize, and the only one the amateur is likely to have firmly fixed in his mind.

Field marks.—The chestnut-sided warbler is one of the easiest of the family to recognize, as both sexes are much alike, the colors of the female being only a little more restricted and duller. The yellow crown, two yellowish wing bars, chestnut sides, and pure white breast, together with the black and white head pattern, are all conspicuous field marks for the adults. The young bird in fall plumage lacks the bright yellow crown and most of the chestnut sides, the upper parts being bright greenish yellow and the under parts grayish white, but it has the wing-bars and a white eye ring.

Enemies.—This warbler is well known to be one of the commonest victims of the cowbird, and Dr. Friedmann (1929) records two cases in which the egg of the imposter had been buried in the bottom of the nest.

Harold S. Peters (1936) mentions one louse and one mite as external parasites on this species.

Winter.—The following notes are contributed by Dr. Alexander F. Skutch: "While the black and white warbler spreads in winter over a vast area and appears to be nowhere really common, the chestnut-sided warbler does exactly the reverse, crowds in winter into an area far smaller than its breeding range, and becomes there, during half the year, one of the most abundant of birds. Known in northern Central America only as a rarely recorded bird of passage, this warbler winters in great numbers in Costa Rica and Panamá. In these countries, it appears to be equally well represented in the lowlands of both the Caribbean and Pacific sides, and continues to be abundant upward to an elevation of about 4,000 feet, above which it rapidly decreases in numbers. There appear to be no definite mid-winter records for altitudes above 5,000 feet, although as a transient it is sometimes found considerably higher.

"In the lofty lowland forests of Costa Rica and Panamá the chestnut-sided warbler is, during the period of its sojourn, the one abundant member of the family, whether migratory or resident. It is by no means restricted to the forest but is found wherever trees grow fairly close together, as in coffee plantations with their planted shade trees or along tree-bordered rivers flowing through the cultivated lands. It habitually forages among the crowns of the trees, usually well above the ground. Solitary in disposition, it does not form true flocks; but because of its great abundance several are at times seen in neighboring trees. By early March, the males, which at the time of their arrival are hardly to be distinguished from the females, are clad in their attractive nuptial dress. On April 5, 1937, among the forests of southern Costa Rica, I found a male so attired who repeated over and over a subdued version of his song—an unusual event, for these warblers seldom sing while in Central America.

"The chestnut-sided warbler has not been known to arrive in Central America before the second half of September, a late date for warblers. By the beginning of October, it becomes numerous; before the end of April, it has vanished.

"Early dates of fall arrival in Central America are: Guatemala—Chimoxan, September 27 (Griscom). Honduras—Tela, October 1, 1930. Costa Rica—San José, September 25 (Underwood), and September 28 (Cherrie); El Hogar, September 27 (Carriker); Basin of El General, September 15, 1936, and October 3, 1942.

"Late dates of spring departure from Central America are: Panamá—Barro Colorado Island, Canal Zone, April 6, 1935. Costa Rica—Basin of El General, April 15, 1936, April 21, 1937, April 25, 1939, April 20, 1940, April 12, 1942, and April 17, 1943; San José, April 24 (Cherrie); Pejivalle, April 28, 1941. Guatemala—Motagua Valley, near Los Amates, April 24, 1932."

DISTRIBUTION

Range.—Eastern North America to Panamá.

Breeding range.—The chestnut-sided warbler breeds **north** to central Saskatchewan (Emma Lake and Hudson Bay Junction); southern Manitoba (Duck Mountain, Lake St. Martin, and Hillside Beach); central Ontario (Kenora, Chapleau, and Lake Abitibi); and southern Quebec (Blue Sea Lake, Quebec, and Gaspé). **East** to southeastern Quebec (Gaspé); Nova Scotia (Antigonish, Halifax, and Yarmouth); and the coast of New England south to Martha's Vineyard. **South** to southern Massachusetts (Martha's Vineyard); southern Connecticut (Saybrook, New Haven, and Bridgeport); northern New Jersey (Elizabeth and Morristown); southeastern Pennsylvania (Berwyn); northern Maryland (Reisterstown); south through the mountains of Virginia, West Virginia, North Carolina, South Carolina (Caesars Head and Highlow Gap); to central northern Georgia (Brasstown

Bald [first breeding record for the State, 1925], Mount Oglethorpe, and Burnt Mountain); southwestern Kentucky (Log Mountain and Black Mountain); central and northwestern Ohio (Columbus and Toledo); northern Illinois (Chicago and Lacon); and central Iowa, rarely (Coralville, Grinnell, and Des Moines). **West** to central Iowa (Des Moines); central to western Minnesota (Minneapolis, Brainerd, Walker, and White Earth); central northern North Dakota (Turtle Mountains); southwestern Manitoba (Carberry); and south-central Saskatchewan (Valeport, Wingard, and Emma Lake).

There is a single record for Alberta of a specimen taken at Red Deer, probably only casual.

Winter range.—The winter home of the chestnut-sided warbler is in Central America from southern Nicaragua (Río Escondido) throughout Costa Rica and western Panamá (Barro Colorado, Canal Zone, and Chitré).

Migration.—Late dates of spring departure from the winter home are: Panama—Barro Colorado, Canal Zone, April 6. Costa Rica—El General, April 25. British Honduras—Cayo District, April 27. Tamaulipas—Cañón Cavelleros, May 16.

Early dates of spring arrival are: Alabama—Anniston, April 16. Georgia—Macon, April 16. South Carolina—Columbia, April 10. North Carolina—Raleigh, April 19. Virginia—Naruna, April 17. West Virginia—Bluefield, April 26. District of Columbia—Washington, April 19. Pennsylvania—Berwyn, April 23. New York—Geneva, April 22. Massachusetts—Taunton, April 25. Vermont—Burlington, May 1. Maine—North Livermore, May 1. Nova Scotia—Halifax, May 4. New Brunswick—Scotch Lake, May 9. Quebec—East Sherbrooke, May 5. Louisiana—New Orleans, March 21. Mississippi—Gulfport, April 14. Arkansas—Delight, April 12. Tennessee—Athens, April 10. Kentucky—Bowling Green, April 26. Indiana—Richmond, April 22. Ohio—Cincinnati, April 25. Michigan—Ann Arbor, April 20. Ontario—Guelph, May 4. Missouri—St. Louis, April 27. Iowa—Iowa City, April 30. Wisconsin—Madison, April 30. Minnesota—Waseca, April 30. Texas—Corpus Christi, March 24. Nebraska—Stapleton, April 25. South Dakota—Lake Poinsett, May 12. North Dakota—Harrisburg, May 15. Manitoba—Margaret, May 14. Saskatchewan—Regina, May 15.

Late dates of the spring departure of transients are: Alabama—Long Island, May 15. Georgia—Atlanta, May 23. South Carolina—Spartanburg, May 18. North Carolina—Greensboro, May 19. Virginia— Charlottesville, May 23. District of Columbia—Washington, June 2. Louisiana—Thibodaux, May 3. Mississippi—Corinth, May 16. Arkansas—Winslow, May 20. Tennessee—Chattanooga, May 20. Kentucky—Lexington, May 15. Iowa—Sioux City, June 4. Texas—Amarillo, May 25. Oklahoma— Kenton, May 21. Kansas—Topeka, May 20. Nebraska—Omaha, May 28. North Dakota—Cando, June 1.

Late dates of fall departure are: Manitoba—Aweme, September 22. North Dakota—Wilton, September 24 (bird banded). South Dakota—Yankton, September 23. Kansas—Osawatomie, October 12. Minnesota—Minneapolis, September 15. Wisconsin—Oshkosh, October 10. Iowa—Davenport, October 2. Ontario—Kingston, September 29. Michigan—Ann Arbor, October 11. Ohio—Oberlin, October 12. Illinois—Lake Forest, October 4. Kentucky—Bowling Green, October 20. Tennessee—Memphis, October 21. Mississippi—Ariel, October 19. Quebec—Quebec, August 28. New Brunswick—Saint John, September 10. Maine—Phillips, September 17. New Hampshire—Hanover, September 19. New York—Rhinebeck, October 8. Pennsylvania—Berwyn, October 15. District of Columbia—Washington, October 14. West Virginia—Bluefield, October 5. North Carolina—Highlands, October 18. South Carolina—Clemson College, October 26. Georgia—Round Oak, October 27. Alabama—Birmingham, October 18.

Banding.—Like most warblers, few of the chestnut-sided have been banded. One return is of some interest. It was banded as an adult at Holderness, N. H., on June 25, 1926, and was retrapped at the same station on July 3, 1927.

Casual records.—In 1887 a specimen was collected near Nanortalik, Greenland, four have been taken in western Cuba, in 1940 and 1941, and one was collected at Cheyenne, Wyo., on May 23, 1889. In Colorado a specimen was taken at Barr Lake, May 16, 1933; one was reported near Denver on May 31, 1935; and another at Boulder, April 29, 1942. In California, one was reported at Sherwood, Mendocino County, September 21, 1908, and another was caught in a banding trap, September 24, 1946, at Manor, Marin County. There is one record for New Providence, Bahamas, without date.

Egg dates.—Massachusetts: 86 records, May 22 to July 2; 64 records, May 30 to June 9, indicating the height of the season.

New York: 27 records, May 30 to July 5; 14 records, June 1 to 9.

Pennsylvania: 18 records, May 27 to June 17; 10 records, May 31 to June 7 (Harris).

DENDROICA CASTANEA (Wilson)

BAY-BREASTED WARBLER

Plate 47

HABITS

Bartram's "Little Chocolate-breasted Titmouse" was given the above name by Wilson (1832), based on a specimen taken in eastern Pennsylvania. Both he and Audubon considered it a rare species and had little to say about it. This is not strange, for they probably never saw it on its breeding grounds and probably overlooked it on its rather rapid migrations, or perhaps confused it with others in the host of migrants. To see the bay-breasted warbler to advantage one must visit the coniferous forests of northern New England and southern Canada east of the Great Plains; here it is often an abundant bird, and in some places it is the commonest of the warblers.

In Maine, according to Ora W. Knight (1908), "the species is rare and local, even in migration, and as a summer resident is chiefly confined to the deeper wilder sections of the State within the Canadian fauna. * * * The few pair that remain to nest in southern Penobscot County are to be found in the low, rather swampy maple and birch growth, mixed with firs and spruces. * * * In northern Maine I have met with the species in the rather swampy evergreen or mixed growth about the ponds and lakes and judge these localities are their favorite haunts."

Of its range in New Hampshire, Dr. Glover M. Allen (1903) writes: "In the White Mountains and northward it is a fairly common summer resident mainly of the upper Canadian zone. The range of this species in summer overlaps that of the Black-poll Warbler for about 1,000 feet, and extends below it to nearly an equal amount. Thus one finds breeding birds at an altitude of from 1,800 feet in rich, damp coniferous woods on southern exposures, up to about 4,000 feet among the small balsam timber."

Spring.—How the bay-breasted warbler reaches the coast of Texas from its winter home in Colombia and Panamá seems to be unknown. Alexander F. Skutch tells me that it is perhaps only an accidental transient in Central America north of the Isthmus of Panamá. It seems to be unknown in Mexico, but George G. Williams (1945) lists it among the warblers that occur regularly and frequently along the coast of Texas each spring. I saw it in the wave of migrating birds that I observed on an island in Galveston Bay on May 4, 1923. In order to avoid Mexico, it may fly partially across the Gulf of Mexico, or perhaps it may fly only along the coastline. It has also been observed flying directly across the Gulf from Yucatán to the Gulf States. Dr. Chapman (1907) says:

> On the way to its summer home, the bird shuns Mexico, the West Indies, and the United States south of Virginia, east of the Allegheny Mountains; the great bulk passes north through the Mississippi Valley, west to eastern Texas (Corpus Christi, Port Bolivar), Missouri (Freistart), and Iowa (Grinnell); casual or accidental in South Dakota (May 1888), Montana (Big Sandy, May 24, 1903), and Alberta (Medicine Hat). * * * Although close observation will reveal the presence of Bay-breasts during both the spring and fall migrations, they are generally to be classed among the rarer Warblers the mere sight of which is stimulating. Occasionally, however, the weather so affects their migration that they come *en masse* and for a brief period are actually abundant.

William Brewster (1906), referring to the Cambridge region of Massachusetts, writes: "During the spring flight northward, which passes late in May, they usually occur singly and in dense woods, especially such as consist largely of white pines, hemlocks or other coniferous trees. A remarkable exception to this rule happened in 1872. On May 26 of this year several birds were seen in the heart of Cambridge, and on the following morning I found upwards of *forty*, most of them females, feeding in the tops of some large oaks." This is about as far east as the bay-breasted warbler usually comes in Massachusetts; it is an exceedingly rare bird in the southeastern corner of the state; I can count on the fingers of one hand all that I have ever seen there. Most of the birds probably pass up the Connecticut Valley, or farther westward.

Nesting.—It was while I was visiting with Mr. and Mrs. Richard B. Harding at their summer camp on the shore of Lake Asquam, N. H., that I saw my first and only nest of the bay-breasted warbler. The nest was placed on a horizontal branch of a white pine standing on the edge of a clearing in heavy mixed woods, within 20 yards of a cottage, and it was about 30 feet above the ground. On June 5, 1930, the nest was not quite finished. On June 8, Mr. Harding climbed the tree and found that the nest contained two eggs, but on the sixteenth the nest was empty, and was taken. Mrs. Harding described it in a letter to me as being made largely of coarse, dried grass stalks, with a few hemlock twigs and a piece of string—a loosely built structure, with straws and twigs protruding from it on all sides. The inner wall of the nest was made of dried grasses and pine needles, with a thin lining of fine, black rootlets and horsehairs.

Miss Cordelia J. Stanwood has sent me some extensive notes on the home life of this warbler, in which she describes the building of the nest as follows: "First a few culms of hay were placed in the fork of several twigs on a flat limb; next fine spruce twigs were anchored to the various points of attachment, and the nest shaped of these. The lining consisted of a very few runners of cinquefoil, a very few pine leaves, and much horsehair and human hair."

Philipp and Bowdish (1917) during two seasons in New Brunswick found nine nests of the bay-breasted warbler. Of the six nests found in 1915, all "were in small spruces, two of them being well out on horizontal limbs, the others close to the trunk, at heights varying from four to ten feet. None were very well concealed and some of them were remarkably open, but they blended so well with their surroundings that they were exceedingly difficult to discern. All of the nests of this species that we found resemble large structures of the Magnolia Warbler, being rather loosely constructed, of fine spruce of similar twigs, exteriorly, a little dead grass and some insect webs entering into the composition, and fine, black rootlets being commonly used as a lining." Two of the nests found in 1916 were higher up; one was "fifteen feet from ground, supported by two horizontal branches, against the main stem of a small balsam, near its top, in a clump of same, in partial clearing in spruce forest." The other was "twenty feet up against the trunk of a spruce tree at the edge of a clearing. This latter nest was in a very thick portion of the foliage and absolutely invisible from the ground, being found only by flushing the bird." F. H. Kennard mentions in his notes several nests, found in New Hampshire, that were from 25 to 40 feet up, "in the lower, outreaching branches of tall spruces." William Brewster (1938) mentions one that was 50 feet up.

A nest before me, taken by Richard C. Harlow in New Brunswick, was placed 12 feet up and 10 feet out toward the end of a long horizontal limb of a small, slender spruce in a high, dry spruce forest. It is very well and compactly made, mainly of fine spruce twigs firmly woven into a solid and fairly smooth rim, with only a few fine grasses woven in. It is neatly and smoothly lined with a thick bed of the finest black rootlets. The nest was so placed that another limb was only two inches directly above it.

The measurements of several recorded nests vary from 2 to 2¾ inches in outside depth, from 1¼ to 1½ in inside depth, from 4 by 3½ to 5⅔ in outside diameter, and from 2$\frac{1}{10}$ to 2½ inches in inside diameter, according to Mendall (1937).

Eggs.—The bay-breasted warbler lays large sets of eggs, from 4 to 7, but 5 is by far the commonest number, though sets of 6 are not very rare. The eggs vary in shape from ovate to elongate ovate and they are slightly glossy. The ground color is white, creamy white, pale bluish white or pale greenish white. They are handsomely speckled, spotted and blotched with "auburn," "bay," raw umber," "argus brown," "chestnut," "chestnut-brown," "Mars brown," or "snuff brown," with underlying spots of "light Quaker drab," "light mouse gray," "deep brownish drab," "vinaceous drab," or "light purplish drab." There is a wide variation in the manner of markings, some being spotted with the reddish browns, others with shades of "Brussels brown" or "snuff brown." Then too, eggs may have two or three shades of brown mixed with the undertones of drab; or they may be marked only with tones of a single shade of brown and drab. Generally they are boldly spotted, sometimes with a few scrawls of black; while the coloring is concentrated at the large end, there is less tendency to form a distinct wreath than in many other warbler eggs. The measurements of 50 eggs average 17.7 by 12.9 millimeters; the eggs showing the four extremes measure **19.0** by 13.4, 18.0 by **13.5, 16.4** by 13.3, and 17.5 by **12.3** millimeters (Harris).

Young.—Howard L. Mendall (1937) gives the following summary of his study of the home life of the bay-breasted warbler:

> The period of incubation was observed to be slightly over twelve days, and the eggs hatched at intervals, with more than two days between the hatching of the first and the fifth egg. Two young left the nest at eleven days of age. Incubation and brooding apparently are carried out solely by the female, which is, at least part of the time, fed on the nest by the male. During the observation periods from June 28 to July 3 (when there were five young in the nest), the female averaged 26.4 feedings per hour, while the male fed on the average of 13 times an hour. However, under certain conditions and for short periods of time, the male performed a much greater proportion of the nesting duties. Both adults and one of the young were still together in the vicinity of the nest eight days after the home had been forsaken.

He observed that, during a heavy thundershower, the female stood over the young and sheltered them with her wings spread over the sides of the nest; on a hot, sunny day she protected them from the heat of the sun in a similar manner. Two of the young were killed by a red squirrel and the last one disappeared before leaving the nest. Only the first two to leave the nest survived.

Miss Stanwood's notes contain the following account of the activities of the young a day or two before leaving the nest: "One little bird after another pushed his way to the top of the bird heap, pecked at the oil gland situated on the rump, wet his beak with oil, then dragged one wing up slowly and oiled one feather at a time, pulling the feather firmly through his beak from the root to the tip. Thus he made his feathers waterproof and beautiful; thus, also, he removed those annoying quill casings. After moistening his beak with oil the bird rests; after preening a wing the bird rests again; then he moistens his beak once more, rests, then preens the other wing and rests. The bird may have been fed a number of times while this process is going on. After feeding once more, and after the parent has again carried away the excreta, he is thoroughly rested and his toilet is in perfect condition. He is now ready to let another little warbler press to the top of the nest in his place."

Plumages.—Miss Stanwood (MS.) refers to the natal down as brown. Dr. Chapman (1907) describes the nestling in juvenal plumage as "above grayish olive, the head sometimes paler, nearly buffy, back heavily spotted with wedge-shaped black marks; below whitish thickly spotted with *rounded* black marks; median wing-coverts broadly tipped with white or buffy white on both webs, the greater coverts, on only the outer web."

A partial postjuvenal molt, involving the contour plumage and the wing coverts but not the rest of the wings or the tail, occurs in July and August and produces the first winter plumage. Dr. Dwight (1900) describes the young male in this plumage as "above, yellowish olive-green, with dusky streaks on the crown, a few concealed black spots on the back, the upper tail coverts cinereous gray. Wing coverts edged with olive-green and two broad wing bands white tinged with yellow. Below, cream-color washed with straw-yellow on the throat and with a very little chestnut on the flanks." It resembles the young blackpoll, but is "a yellower olive above, a buffier yellow below and a wash of chestnut on the flanks, with less definite streaking above and none below." The female is distinguishable from the male in the first winter plumage, "which is a clearer green without the crown streaks of the male, the black spots on the back duller and usually even a trace of chestnut is lacking on the flanks."

The first nuptial plumage is acquired before the birds come north by a partial prenuptial molt "which involves most of the body plumage and wing coverts but not the rest of the wings nor the tail. The deep chestnut crown, paler throat and lateral stripes, black sides of the head and forehead, olive-gray back streaked with black, the rich buff patches on the sides of the neck and the black wing coverts, plumbeous-edged and white-tipped, are all assumed." Adults and young are now practically indistinguishable, except for the worn and duller wings and tail in the young bird. The female has the same color pattern as the male but the colors are much duller and there is less chestnut.

Adults have a complete postnuptial molt, mainly in July. Dr. Dwight (1900) describes the plumage of the winter male as "similar to first winter dress, but the crown, nape and back distinctly streaked with black, creamier tints below and the flanks striped distinctly with chestnut, the wings and tail blacker and the edgings grayer rather than greener as in the young bird; a few chestnut feathers sometimes appear on the throat and crown." The adult female in winter is similar to the first winter female, "but whiter below, with a wash of chestnut on the flanks and with crown streaks and the dorsal spots better defined, resembling closely the male first winter dress, although usually rather duller."

The prenuptial molt of adults is similar to that of young birds.

Food.—Like other wood warblers, the bay-breasted is almost wholly insectivorous, indulging occasionally, perhaps, in a little wild fruit. No intensive study of its food seems to have been made. Edward H. Forbush (1929) says that "it takes locusts, caterpillars, ants, beetles and leaf-hoppers." Miss Stanwood (MS.) saw moths and other insects and their larvae fed to the young.

Behavior.—At the nest studied by Mr. Mendall (1937)—

> The adult birds showed a remarkable degree of adaptability in the face of the four changes in location to which the nest was subjected. In fact, for a species of the woodlands, the Bay-breasted Warbler appears to be exceedingly tame and unsuspicious in the presence of man. * * * She was reluctant to leave the nest, even when I had climbed within three feet of her, and it was not until the branches had been pulled to one side that she departed. Injury-feigning was very much in evidence. The bird dropped to a lower limb of the tree and almost literally crawled through the foliage in front of me. The left wing was extended and drooped, the tail was twisted to the left and the feathers spread. The bird uttered no sound, but continued to move through the branches for about fifty seconds after which she flew around me, several times coming very close to my head, and scolded violently. This protest brought the male to the scene and he joined his mate in uttering notes of alarm, though with less vigor.

Voice.—Aretas A. Saunders contributes the following study: "The song of the bay-breasted warbler is much like that of the blackpoll in high pitch and quality, and in having little or no change in pitch throughout. The time, however, is not even and regular; short and long notes are alternated or irregularly mixed. There is no definite increase in loudness.

"I have only 18 records of this song, as the bird is uncommon and seems to sing less frequently on migration than the other species. Six of these songs show no change in pitch, while the others change but slightly, half a tone to a tone. The pitch in the different songs varies from B'''' to E''''', a range of only two and a half tones. A larger number of records would probably show a greater range than this.

"All but one of my records are from migrating birds in Connecticut. One record from the breeding grounds in the Adirondacks is remarkably different, particularly in the matter of time. The records from migrating birds vary from ⅗ second to 2 seconds, but the record from the breeding grounds is 4⅗ seconds. This record is also remarkable in its rhythm, containing groups of three notes each that, in their time arrangement, suggest the 'peabody' notes of the song of the white-throated sparrow. The song, which is all on one pitch, might be written *Teee teelelee te te teee teee teelelee teelelee teelelee tee.* With only this one record of the summer song, I cannot determine whether it is typical of the breeding songs of this species or is unusual."

Gerald H. Thayer wrote to Dr. Chapman (1907):

> In a grouping based on songs, the Bay-breast should stand in a quintette with the Blackburnian, the Black-poll the Black and White and the Cape May. These five heard singing together in the same trees, as I have heard them on the Hudson River, make 'confusion worse than death' for any bird-student but the most adept. But with patience and a good ear one can learn to differentiate them surely. All five are thin-voiced, "sibilant," singers; but each has its own slight, prevailing peculiarity of tone, in addition to the differences, varied but never wholly violated, of phrasing and accentuation. The Bay-breast's singing, in the spring at least, is the most liquid and inarticulate of the lot, and sometimes the loudest. It varies greatly, from the bases of at least two and probably three clearly distinct main songs. In one of these, the six or more barely-separated lisping notes are all alike in volume, accentuation, tone, and speed. They are slightly louder than the Black-poll notes, and not quite so smooth in tone. Another song begins in about the same way, but ends with three or four clearly-separated louder notes, which have a more nearly full-voiced ring. A third, uncommon, song, which I have all but surely traced to the Bay-breast, is louder throughout, and otherwise very different. It begins with about ten penetrating notes, in close-knit couplets like those of the Black and White's shorter song, and of much the same tone, but louder; and it ends, abruptly, with a single, lower-toned, much richer note, like a fragment of Oven-bird song.

Philipp and Bowdish (1917) say: "The song is of a character quite similar to that of the Blackburnian Warbler, but slightly stronger and louder. It is delivered for long periods, with considerable frequency, and at all times of day, though less frequently toward the middle of the day. It appears that the female sings from the nest, in answer to the male, and the song is markedly weaker, being scarcely distinguishable from that of the Blackburnian Warbler. The approach of an intruder is apt to cause the female to become silent."

Field marks.—The adults of both sexes are unmistakable, with their conspicuous chestnut markings on crown, breast, and sides, black cheeks and a buffy spot on the side of the neck, in spring plumage, the females being duller in colors and with less chestnut. Fall birds might easily be mistaken for blackpolls, which they closely resemble, but adults usually have some trace of chestnut wash on the sides, less streaking above, and none below. Young birds have no trace of chestnut on the sides. The under tail coverts of the bay breasted warbler are cream-color, while those of the blackpoll are pure white.

Fall.—Bay-breasted warblers are often very common on the fall migration, sometimes really abundant. That they are sometimes commoner than we realize is a result of the difficulty of distinguishing them from the blackpolls as the two are migrating through the treetops together. As a rule, however, the bay-breasted warblers are earlier migrants, passing through New England during the last half of August and the first week of September, then in company with the blackpolls for the next two weeks, after which very few of them may be seen. In my experience, the blackpolls far outnumber them in New England, being by far our commonest warbler in the fall. The fall migration route of the bay-breasted warbler is apparently a reversal of the route followed in the spring, southward west of the Alleghenies and west of or across the Gulf of Mexico to Panamá and Colombia.

DISTRIBUTION

Range.—Southern Canada to northwestern South America.

Breeding range.—The bay-breasted warbler breeds **north** to northeastern British Columbia (Lower Liard Crossing); northern Alberta (Athabaska Lake near Chipwyan); casually north to southwestern Mackenzie (Wrigley); central Saskatchewan (Flotten Lake); central Manitoba (Berens Island, Lake Winnipeg, and possibly Oxford House); central Ontario (Gorman Creek, Patricia district; Lac Seul, Lake Nipigon, and Moose Factory); and southern Quebec (Mistassini Post, Piasti, and Natashquan); casual north to Hamilton Inlet, Labrador. **East** to southeastern Quebec (Natashquan); west-central Newfoundland (Grand Lake); and Nova Scotia (Baddeck, Pictou, and Halifax). **South** to Nova Scotia (Halifax); southern Maine (Ellsworth and Thomaston); central and southwestern New Hampshire (Tamworth, Webster, and Mount Monadnock); northern New York (Adirondack Mountains); southern Ontario (Southmag and French River); northern Michigan, rarely (Sugar Island, St. Mary's River, and Isle Royale); northern Minnesota (Clear Lake and Itasca Park; possibly Elk River); southwestern Ontario (Off Lake, Rainy River district); southern Manitoba (Indian Bay, Lake of the Woods, and Aweme); central Saskatchewan (Flotten Lake); central Alberta (Glenevis, Faust, and Sturgeon Lake); and central eastern British Columbia (Charlie Lake). **West** to northeastern British Columbia (Charlie Lake and Lower Liard Crossing; possibly Indian Point Lake and Tatana Lake).

Winter range.—In winter the bay-breasted warbler is found **north** to central Panamá (Canal Zone); the coastal region of Colombia (Santa Marta region); and Venezuela (Rancho Grande and Tortuga Island). **South** to northern Venezuela (Tortuga Island, Mérida, and La Uraca); and west central Colombia (Valvidia). **West** to western Colombia (Valvidia and Río Frío); and eastern Panamá (Cana and Canal Zone).

Migration.—Late dates of departure from the winter home are: Colombia—Malena, March 10. Panamá—Toro Point, April 27.

Early dates of spring arrival are: Mexico—Gómez Farías, Tamaulipas, April 2. Florida—Pensacola, April 23. Alabama—Sand Mountain, April 20. Georgia—Roswell, April 21. North Carolina—

Piney Creek, April 24. Virginia—Lynchburg, May 3. West Virginia—Wheeling, May 2. District of Columbia—Washington, May 2. Pennsylvania—Philadelphia, May 2. New York—Ithaca, May 1. Massachusetts—Amherst, May 7. Vermont—St. Johnsbury, May 5. Maine—Lewiston, May 10. Quebec—Montreal, May 18. New Brunswick—Scotch Lake, May 10. Nova Scotia—Yarmouth, May 21. Louisiana—Thibodaux, April 12. Mississippi—Deer Island, April 19. Arkansas—Monticello, April 24. Tennessee—Greenbrier, April 10 (specimen). Kentucky—Bowling Green, April 29. Indiana—Bloomington, April 29. Ohio—Oberlin, April 28. Michigan—Ann Arbor, May 3. Missouri—St. Louis, May 1. Iowa—Giard, May 7. Wisconsin—Madison, May 3. Minnesota—St. Paul, May 4. Texas—Olmito, April 23. Kansas—Topeka, May 8. Nebraska—Greeley, May 3. South Dakota—Yankton, May 10. North Dakota—Fargo, May 9. Manitoba—Margaret, May 13. Saskatchewan—Indian Head, May 10.

Late dates of spring departure of transients are: Florida—Pensacola, May 13. Alabama—Long Island, May 22. Georgia—Athens, May 13. South Carolina—Clemson (College), May 16. North Carolina—Asheville, May 19. Virginia—Charlottesville, May 28. West Virginia—Morgantown, May 22. District of Columbia—Washington, June 5. Pennsylvania—Laanna, June 7. New York—Brooklyn, June 3. Massachusetts—Northampton, June 9. Louisiana—New Iberia, May 15. Mississippi—May 16. Arkansas—Rogers, May 27. Tennessee—Nashville, May 24. Kentucky—Danville, May 19· Illinois—Chicago, June 5. Indiana—Notre Dame, June 4. Michigan—Ann Arbor, June 6. Ohio—Toledo, June 5. Missouri—St. Louis, June 2. Iowa—Sioux City, June 4. Wisconsin—Berlin, June 3. Texas—Laguna Vista, May 15. Oklahoma—Kenton, June 4. Nebraska—Hastings, May 25.

Early dates of fall arrival are: Minnesota—Minneapolis, August 21. Wisconsin—New London, August 15. Michigan—McMillan, August 6. Ohio—Toledo, August 6. Indiana—Dune Park, August 20. Illinois—Glen Ellyn, August 13. Kentucky—Bardstown, September 15. Tennessee—Roan Mountain, September 23. Mississippi—Bay St. Louis, September 23. Massachusetts—Harvard, September 5. New York—Rhinebeck, August 11. Pennsylvania—Pittsburgh, August 20. District of Columbia—Washington, August 17. West Virginia—Bluefield, August 29. Virginia—Lexington, September 19. North Carolina—Mount Mitchell, September 12. Georgia—Young Harris, September 29. Alabama—Birmingham, September 13.—Florida—Pensacola, October 1. Panamá—Cocoplum, October 24. Colombia—Novita, September 20.

Late dates of fall departure are: Manitoba—Aweme, September 26. Minnesota—St. Paul, September 29. Wisconsin—Racine, October 8.

Iowa—Lamont, October 2. Michigan—Detroit, October 19. Ontario—Point Pelee, October 15. Ohio—Youngstown, October 21. Indiana—Indianapolis, October 20. Illinois—Olney, October 20. Kentucky—Danville, October 20. Tennessee—Memphis, October 28. Mississippi—Saucier, October 24. Louisiana—New Orleans, October 11. New Brunswick—Grand Manan, September 16. Quebec—Montreal, October 12. Maine—Avon, September 17. Vermont—Wells River, October 13. Massachusetts—Taunton, October 8. New York—Geneva, October 12. Pennsylvania—Jeffersonville, October 20. District of Columbia—Washington, November 6. Virginia—Lawrenceville, October 12. North Carolina—Asheville, October 19. South Carolina—Mount Pleasant, October 18. Georgia—Athens, November 15. Alabama—Birmingham, October 25. Florida—Pensacola, October 27.

Casual records.—A bay-breasted warbler was collected at Big Sandy, Mont., on May 24, 1903; and one was carefully observed in a bird bath at Fort Morgan, Colo., on May 19, 1933. A juvenile was shot at Narssaq, near Godthaab, Greenland, on October 15, 1898. A specimen has been taken in Bermuda.

Egg dates.—Maine: 8 records, June 3 to 16; 5 records, June 10 to 15.

New Hampshire: 9 records, June 12 to 28; 5 records, June 13 to 18.

New Brunswick: 52 records, June 5 to July 2; 30 records, June 17 to 25, indicating the height of the season (Harris).

DENDROICA STRIATA (Forster)

BLACK-POLLED WARBLER

Contributed by Alfred Otto Gross

Plate 48

HABITS

The common or vernacular name black-polled warbler owes its origin to the conspicuous and distinctive black crown of the adult male. The beginner, when first learning to differentiate the warblers, is likely to compare the blackpoll with the black and white warbler, since these two birds have the same color combination and lack the bright colors of many of the other species of warblers. In the autumn, however, it is hard for him to believe that the little greenish birds are the same black and white warblers he saw in spring.

The black-polled warbler is a very successful species in its competition with others. Although it encounters many hazards on its very long migration, and countless numbers meet death at this time, it has nevertheless been able to maintain a large and growing population. Anyone who has experienced seeing the great migration waves that arrive late in the season will agree that it is one of our most abundant warblers. One reason for this is the extensive breeding range in the seclusion of the northern coniferous forests stretching across the entire continent from Alaska to the Labrador coast. To be sure, the unusual numbers in eastern United States during the migration are due in part to the fact that the black-polled warblers, breeding in the extensive region to the north, pass in an ever narrowing migration route to their exit at the Florida Peninsula. In spring a reverse condition exists in which the birds spread out as they go north to occupy the great fan-shaped area.

Spring.—This warbler arrives late in the season, at a time when the majority of the trees are in blossom or well leaved out, and since it often frequents the taller tree tops it is sometimes difficult to see, but the frequent songs give evidence of its presence. The blackpoll is deliberate in its movements and usually unsuspicious and approachable. Often during the height of the migration I have seen them along fences and stone walls and even in open fields and pastures searching for food and going about their business apparently unaware of my presence. At times they appear in my garden and backyard, in fact they seem to be in evidence everywhere I go. Then at night, if I am stationed in a quiet place, I hear their characteristic high-pitched calls as, high in the air, they journey on their way.

Migration.—The blackpolls migrate chiefly at night, and since they are readily attracted by bright lights during their flight, we often find concentrations of them in the parks of our larger cities, where they are reported as being seen under the electric lights at night. When daylight comes they naturally seek out places such as parks and public gardens where trees and shrubs provide temporary resting and feeding places. In Central Park, New York City, for example, G. E. Hix (1905) states that the black-polled warbler outnumbers all others put together.

The black-polled warbler winters in northern South America. Birds in migrating to North America may follow a route along the coast of Central America and Mexico, as does the cliff swallow, or they may fly directly over the Caribbean via Cuba and the intervening islands to Florida, the route invariably chosen by the blackpoll. It reaches the Florida coast about April 20, and as it is one of the latest to migrate it seldom reaches the Gulf States before the last week of April. It proceeds leisurely and may be seen long after the majority of other warblers have passed on their way to their nesting grounds. On this part of its migration it travels at a rate not exceeding 30 to 35 miles a day and does not reach southern New England and the northern tier of Central States until about May 15. The individuals that cross the upper Mississippi Valley through Minnesota and the Dakotas then greatly accelerate their pace to about 200 miles per day so that a week later they have reached the central part of the Mackenzie Valley and by May 30 they arrive at the far distant breeding grounds in northwestern Alaska. This long distance is covered in about the same time that the slower-moving eastern contingent arrives in southern Quebec and Newfoundland. About 25 to 30 days are required to travel the distance of 1,000 miles from Florida to Minnesota, whereas the final lap of 2,500 miles is accomplished in less than two weeks. This remarkable change in speed can be correlated with the fact that the advance of spring in the northern interior is much more rapid than it is in the Mississippi Valley and Gulf coast. In the northland spring comes with a rush, and during the height of migration the temperature of the Mackenzie Valley is about the same as it is in Minnesota.

The black-polled warbler breeds principally in Canada and none farther south than southern New Brunswick, the mountains of the northeastern states and in the Rocky Mountains. This means that no blackpoll migrates a distance of less than 2,500 miles, while those individuals that winter in Brazil and nest in northwestern Alaska must travel more than 5,000 miles to reach their nesting grounds. These are straight-line distances, and do not take into account the deviations in the course or the random flights in search for food.

The migration route of the blackpoll from Alaska has been evolved over a long period of time. It is apparent that this bird extended its range from the eastern part of North America to northwestern Alaska. Instead of using the Pacific flyway it retraces its journey across the mountains and moves southeastward over the ancestral route to leave the United States for South America through a funnellike exit by way of Florida. In Arkansas, Louisiana, and the southern part of the Mississippi flyway it is a comparatively rare bird.

In autumn the blackpoll begins leaving its outpost in Alaska in August and, as in spring, it moves more rapidly over the northern section of its journey. After it reaches the States early in September its speed is less pronounced. These warblers are among the last to leave; they may be seen in the United States throughout September and October, and the last individuals do not leave Florida until November.

The distribution of this warbler is not uniform over the entire area included in the migration, and the details of its course taken in spring may vary from that followed in autumn. T. D. Burleigh (1934), in a study of the distribution and abundance of the black-polled and bay-breasted warblers in the southeastern States during the spring and fall migrations, notes that at Athens, Ga., and in the Piedmont region in general the blackpoll is an abundant spring migrant but in the fall is exceedingly scarce. Likewise at Asheville in the mountains of North Carolina, it is an abundant spring migrant and completely absent in autumn. On the coast it is common only in fall. Mr. Burleigh states: "It apparently, in the west to east migration in the fall from its breeding grounds in the far northwest, is moved by some impulse to reach the coast as soon as possible, and as a result it is at best merely a straggler over much of the area it occupies in the spring migration."

Swales and Taverner (1907) have noted that the black-polled warbler, though one of the most abundant fall migrants in southeastern Michigan, is conspicuously absent in the region of Detroit, Wayne County, in spring. No explanation is offered to account for this peculiar situation in that section of its migration journey.

The fall migration of the blackpolls as it occurs in the White Mountains of New Hampshire is of interest. These birds breed commonly in the upper Canadian Zone mainly above 3,000 feet on southern exposures and down to 2,000 feet on the northern slopes. During September they swarm in migration over the low country of the southern part of the State and beyond, but in the valley bottoms among the mountains they are rare. Here they migrate mainly at the upper levels and along the mountain tops. The tendency to migrate at the higher elevations along mountain ranges has been observed in other sections of the migration course. On September 15, 1900, Glover M. Allen (1903) observed a great flight of black-polled and myrtle warblers starting at 4:30 a. m. and continuing for 2 hours in the White Mountains. Several hundred birds passed, of which three-fourths were blackpolls. These warblers came flying in from the south, high in the air, making straight for Carter notch, a great rift in the mountain with a valley opening out toward the north and another to the south. "It seemed," Dr. Allen writes, "as if the blackpoll warblers from all of the forests immediately to the south were moving north in a concerted manner to pass through the notch and off beyond. Possibly they were heading for the Ammonoosuc Valley to continue thence down the Connecticut; this would be a natural course, and one cannot suppose that their northward flight at this season could have been more than some such local movement."

Norman Criddle (1922) has taken migration records of the blackpoll over a period of 21 years at Aweme, Manitoba, Canada, where he finds the average date of appearance in spring to be May 14, with his earliest date on May 9, 1902. In autumn the average date of last birds seen was September 9, and the latest record was one observed on September 15, 1912.

The observations and dates of the spring and fall migration made by M. B. Trautman (1940) at Buckeye Lake, Ohio, are typical of the midwestern section of the migration route. He writes as follows:

> The black-poll warbler was among the last of the warblers to make its appearance in spring. The latest date for spring arrivals was May 15. In the average year a few could be seen daily after May 15, and by May 18 the species was common. At the peak of migration, between May 18 and 27, 10 to 40 birds could be observed daily. The species then generally disappeared suddenly, for by May 29 all except a few stragglers had departed.
>
> The first southbound transients were seen between August 31 and September 14, and the species was always rare until September 15. An increase became apparent by September 17, and from then until October 10 it could be regularly recorded. The peak of migration came between September 25 and October 10, and then 10 to 150 individuals could be daily observed. A sharp decrease in numbers took place between October 10 and 15, and by October 23 the species was usually absent. * * *
>
> The black-poll and bay-breasted warblers were close associates during migrations. Both were late spring and fall transients, both chiefly inhabited trees, and their maximum numbers during migrations were almost equal.

In Maine and Massachusetts the main migration wave of blackpolls comes late in May, but a few forerunners can be expected during the second week of the month and a few exceptionally early records have been made during the first week. It is the only one of the transient warblers that remains until June, and in some years a few belated stragglers linger after the second week in southern Maine. It nests in the northern part of the state.

In autumn the blackpolls arrive in force in September, with some forerunners appearing late in August. They are with us through September and much of October; in Massachusetts dates of last appearances have been reported for November, and one was seen as late as December 17, 1939, at Plum Island, Mass., by Richard Stackpole (1939) and others.

Nesting.—The blackpoll is a bird of the northern spruce forests; in fact, the spruce seems to be an essential requirement for its nesting site. At Kent Island, Bay of Fundy, New Brunswick, I have seen 9 nests, all in small white spruces and all located within the narrow range of 2 to 7 feet from the ground and built snugly against the trunks of the trees. The somewhat bulky structures were well supported in each case by one or two horizontal branches. Most of these New Brunswick nests were well concealed from view by canopies of overhanging branches. A typical nest had an outside diameter of 4½ inches and was 3 inches in depth. The internal dimensions of the cup were 2 inches wide and 1½ inches deep. The foundation was made of small twigs and sprays of spruce, pieces of bark, dried grasses, and weeds mixed with bits of moss, lichens, and wool. The interior of the structure consisted of plant fibers and fine rootlets, some hair, and a liberal lining of white gull feathers. The lining of feathers is characteristic, being as essential to the nest structure as the spruce tree is for a nesting site. The kind of feathers used, of course, depends on the kind that are available; on Grand Manan Island, New Brunswick, it is commonly goose feathers, in the Magdalen Islands in the Gulf of St. Lawrence, duck feathers; in Labrador, duck or ptarmigan feathers; and at Lost River in the White Mountains I have seen nests lined with grouse feathers and odd feathers of song birds. The myrtle warbler also uses feathers in lining its nest, which is more compactly built than the blackpoll's and is generally placed on a horizontal limb away from the trunk of the tree.

J. P. Norris (1890a) describes 17 sets of eggs of the blackpoll and gives the location of 15 nests collected on Grand Manan Island as follows: "They were all found in spruce trees, one of them was found only a foot from the ground; another was eighteen inches; a third two feet up; a fourth three and a half feet; two more were each four feet high; five were five feet up; two were seven feet from the ground; another was eight feet and still another was ten feet high." William Brewster (1882a) describes a nest containing three eggs which he found in the Magdalen Islands on June 23, 1882:

> The nest was built in a low, thick spruce, which stood on the edge of a swamp, near a brook. It was placed on a horizontal branch at a height of about three feet, and was well concealed by the clusters of densely-imbricated needles above. * * * The main body of the structure is composed of Usnea moss, weed-stalks, and dry grasses, closely matted and protected outwardly by coarser stalks and a few dead spruce twigs. The lining is of slender, black moss-stems (which curiously resemble horse hair) cow's-hair and a few feathers. The whole affair is remarkably solid and bulky for a Warbler's nest.

R. M. Anderson (1909) cites an exception to the rule that the blackpoll nests in trees saying of a nest he found June 24, 1908, on Moose Island near Fort Resolution, Great Slave Lake:

> I stepped across a small dead spruce lying on the ground, and a small plainly colored bird darted from the mass of tall dead grass which surrounded the trunk of a fallen tree. The bird disappeared in the underbrush at once without uttering a sound. Concealing myself, I watched about twenty minutes and the bird stealthily approached the nest hopping from bush to bush, occasionally uttering a sharp, nervous *tsip* like the alarm note of the Junco. The bird proved to be a female Blackpoll Warbler. The nest was placed directly on the ground in the middle of a clump of dead grasses, immediately underneath a small, fallen spruce, the trunk of which was lying about ten inches above the ground. The nest was composed of dead grasses, mixed with cottony substances and a little moss, lined with finer grasses, and a few feathers including one tail feather of a fox sparrow. The four eggs were advanced in incubation.

R. MacFarlane (1891) found several nests of the blackpoll on the ground along Anderson River of northwestern Mackenzie well above the Arctic Circle. In the Mackenzie Delta region bordering the Arctic Ocean the blackpoll is found in dense alder thickets in gullies and ravines; nesting some distance beyond the tree limit. A. R. Porsild (1943) found a nest in an alder thicket near the water's edge on the south end of Richards Island, off the Delta, on August 16, 1934. The nest contained many feathers and was lined with the down of *Epilobium* and willow.

At Kent Island, New Brunswick, the blackpolls usually arrive during the last week of May, and they may be heard singing or be seen feeding among the thick spruce growth which covers a large portion of the 2-mile-long island. Courtship and nest building is a slow deliberate proceedure and nests with eggs are not to be found before the second or third week of June.

The major part of nest building was performed by the female, in one instance under observation; the male was in full song during this time, and while he may have assisted in gathering nesting material I never saw him do any construction work at the nest. The nest contained one egg on June 16, 1932, but it was not until June 22 that the fifth and final egg of the set was laid. Two nests found by Ernest Joy, warden at Kent Island, contained one egg each on June 11, 1943. Each set of five eggs was complete on June 15, indicating that in these two cases an egg was laid each day until the sets were completed.

The female sits very closely when incubating; by moving cautiously I have approached within a few feet of the bird before she fluttered away. At the New Hampshire Nature Camp, Lost River, N. H., in the White Mountains, a blackpoll built a nest in a small spruce tree standing alongside a trail used frequently each day by numerous students. The incubating female paid no attention to passing persons unless they stopped to examine the nest more closely. When thus forced to leave the nest, she slipped off into the dense growth of spruces but emerged soon to utter sharp alarm notes. These calls invariably brought the male to the scene, and together they would protest the intrusion. The male guards his territory zealously and is ever ready to challenge a bird of his own kind or any stranger that appears in the vicinity. In addition to his singing and duties as guardian I have seen him bring food to the female at the nest. One of the best ways to locate a nest containing eggs is to follow a male carrying some larvae or insect to his mate. A nest of course can be quite easily located in this manner after it contains young, by watching either parent.

Dr. Herman R. Sweet made a study of nesting black-polled warblers at Kent Island during the summer of 1933. His arrival at the island was too late to observe their behavior during courtship, nest building, or incubation, save for 2 hours spent in the blind erected within 4 feet of the nest, on June 29, the day before the eggs hatched. During the 2 hours the female incubated the eggs for a total of 92 minutes, in five periods. The shortest time spent incubating was 11 minutes, and the longest 25 minutes, the average being 18.5 minutes. I have noted that other incubating warblers often exhibit considerable restlessness toward the end of incubation and at this time leave the nest more frequently and for longer periods of time. Presumably the same may have been true of the blackpoll observed by Dr. Sweet.

When not on the nest the female could be heard flying about in the nearby trees searching for food, but she made not the least sound when approaching the nest. She invariably came to the nest from a lower level and after reaching the base of the reclining spruce in which it was located hopped up to the nest. While incubating she often dozed with her eyes shut, but upon hearing the least sound she suddenly became alert.

Eggs.—Complete sets of black-polled warbler eggs vary from three to five, but four or five are more usual. The eggs have a white or light creamy buff or sometimes a pale greenish ground color, with brown and umber specks scattered over the whole surface and numerous spots and blotches of reddish brown and subdued shades of lilac and lavender concentrated at the larger end, sometimes forming a wreath.

The weights and measurements of a set of eggs found on Kent Island, June 28, 1932, were taken by Dr. Sweet as follows: 1.7 by 1.4 cm., 1.8 gm.; 1.9 by 1.35 cm., 1.8 gm.; 1.85 by 1.7 cm., 1.7 gm.; 1.85 by 1.9 cm., 1.9 gm. The average of 77 eggs collected by J. P. Norris (1890a) is .72 by .54 inch. Of this series the eggs showing the four extremes measure .79 by .54, 73 by .55, .68 by .49, and .69 by .47 inch. The average of 15 eggs collected by P. B. Philipp (1925) is .70 by .55 inch; the largest measures .74 by .56, and the smallest .66 by .54 inch. A set of eggs collected by N. S. Goss (1891) on June 19, 1880, at Grand Manan, New Brunswick, were unusually large, with the following measurements: .77 by .55, .78 by .56, .78 by .56, and .79 by .56 inch.

The measurements of 50 eggs average 17.9 by 13.4 millimeters, the eggs showing the four extremes measure 21.8 by 13.7, 18.3 by 14.7, and 16.3 by 12.7 millimeters (Harris).

Young.—The incubation period of the blackpoll is at least 11 days, but the exact time was not determined because it was not possible to ascertain the exact date when incubation started. Apparently it may start before the set of eggs is completed, for in one instance 2 days elapsed between the hatching of the first and last of five eggs.

After the young appear the adults exhibit even less fear of a human observer. At Lost River, N. H., on June 30, 1932, I stood in full view, within 5 feet of a nest to take pictures of the adults feeding the young. The female was not in the least disturbed by my presence, but the male at times displayed some reluctance in coming directly to the nest. Both male and female feed the young, but often the male would present his mate at the nest with a larva, which she would accept and in turn feed it to the young. At first small green larvae and aphids were fed to the young but by the time they were 6 days old spiders and large adult insects also were delivered. The nest was always kept clean; the fecal sacs were eaten or carried away as soon as they appeared. As is true of many other passerine birds, the adults after feeding a youngster may stimulate it with a gentle stroke of their beak, causing the fecal sac to appear.

The following observations are from the unpublished notes of Dr. Herman Sweet on black-polled warblers nesting at Kent Island. On June 30, 1933, three of the eggs hatched, one in the morning at 9:40 a. m. the other two at 7:45 p. m. A fourth egg, which was cracked, failed to hatch and was removed by the following morning. One of the three young died and was removed by Dr. Sweet on the second day. At the time of hatching, the natal plumage consists of delicate tufts of grayish down located on the head, humeral, crural, alar, and caudal tracts.

The first young to hatch opened its mouth widely for food as soon as it was free from the egg although the adults were not present to stimulate such behavior. After this occurred, both the female and male arrived at the nest but neither had food for the young. The male left the nest at once and the female left later, to return in 5 minutes without food. After brooding the lone young for 11 minutes she left again and returned in 5 minutes with a green larva. The larva was minced in her bill and fed to the young just 43 minutes after it had left the shell. The female brooded 5 minutes then left in search of more food. This procedure was repeated six times during the period of observation 9:40 to 11:08. The female brooded 63 minutes or 71.4 percent of the time. The longest single period was 21 minutes and the shortest 5 minutes. Of the six times she left the nest she returned with food four times. During observations made between 2 and 3 p. m. the female did not make any feedings, although she left the nest occasionally. One of the remaining eggs was pipped at this time.

At 7:45 p. m. two more eggs had hatched and the shells had been removed. At 7:59 the male appeared at the nest; the female sat on the rim while he fed the young a minced green caterpillar. He left in 25 seconds and the female again brooded. At 8:12 the male was back again with more larvae. This time the female paid no attention to his presence. The male then uttered a soft twittering sound, whereupon she hopped up on one side of the nest and he fed at least one young. At 8:45 p.m. a flashlight was turned on the nest. She raised up her breast, inspected her young and then settled down for the night.

On July 2, when 2 days old, the young had developed noticeably, with feather papillae showing on ventral tracts. On the following day feather papillae also appeared on the caudal, alar, crural, and humeral tracts, and tail. None had yet appeared on the head and femoral regions. On July 4, at 4 days, sheathed feathers appeared on all tracts except the head. When the male came to the nest to feed the young, if they did not open their mouths he uttered a *tweet* to which they all responded. The young twittered weakly when fed. On July 5 their eyes were open and the feathers on the caudal and ventral tracts were beginning to unsheath at their tips.

As the young grew larger and acquired their juvenal plumage at 8 or 9 days, they frequently stood on the edge of the nest when alone and went through gymnastic exercises by flapping their wings, thus gaining strength in preparation for the time of their first flight. They also frequently preened their rapidly growing feathers to assist in removing the sheaths.

At 10 days, the young exhibited distinct signs of fear. The following day the nest was empty. (By the eleventh day, in another nest under observation, two of four young had left the nest.) The adults continued to feed the young in the vicinity of this nesting site for several days, after which the entire family disappeared from the scene.

Plumages.—Jonathan Dwight, Jr. (1900), has described the plumages and molts of the blackpoll as follows:

> [Juvenal plumage] above, including sides of the head, olive-gray obscurely streaked or mottled with dull black. Wings and tail, clove-brown edged with dull olive-green, whitish on the tail, tertiaries and wing bands. Two rectrices with white terminal spots on the inner webs. Below, dingy white mottled with dull black. Bill and feet pinkish buff, the former becoming dusky, the latter sepia.
>
> First winter plumage acquired by a partial postjuvenal moult in July and August in eastern Canada, which involves the body plumage and the wing coverts, but not the rest of the wings and the tail.
>
> Similar to previous plumage but unspotted. Above, including sides of head, olive-green, olive-gray on tail coverts, rather obscurely streaked, chiefly on the back, with black. The wing coverts clove-brown edged with olive-green and tipped with white, yellow tinged. Below, very pale canary-yellow, white on abdomen and crissum with a few obscure grayish streaks on the throat and sides. A narrow and obscure superciliary line and orbital ring pale canary yellow, the lores whitish, a faint dusky transocular stripe. One or two black crown feathers are occasionally assumed.
>
> Resembles *D. castanea* and *D. vigorsii* but distinguishable from either of them by the streaked back and duller colors.
>
> First nuptial plumage acquired by a partial prenuptial moult which involves most of the body plumage, the wing coverts and tertiaries, but not the rest of the wings nor the tail. Young and old become indistinguishable. The black cap

and black and white plumage are assumed, at first evidently, somewhat veiled by whitish edgings.

Adult winter plumage acquired by a complete postnuptial moult in July. Similar to first winter dress but whiter below, the streaking often distinctly black and extending to the chin, which is spotted here and there; above the crown is decidedly streaked or marked with stray black feathers; the wings and tail are blacker and the edgings are darker and grayer especially on the tertiaries. The slight sprinkling of black feathers is like that found in *Dolichonyx orizivorus* and some other species in the autumn.

[Female] * * * plumages and moults correspond to those of the male, from which it is first distinguishable in first winter plumage, but not in every case. Females are then a little greener above and yellower below including the crissum, the streaks on the side extremely faint. The first nuptial plumage acquired by moult is a little paler than the first winter, the head, back and sides with distinct black streaks; resembles the male in first winter dress but more decidedly streaked. The adult winter plumage is practically indistinguishable from the first winter but rather paler and with the wing edgings darker. The adult nuptial plumage much resembles the male in adult winter dress and is merely tinged with yellow and streaked on crown, back, sides of chin, and sides with black. The black cap and broad streaking of the male are never acquired.

The fall or winter plumage of the blackpoll is so similar to the first winter plumage of the bay-breasted warbler that even the most experienced field observers find them extremely difficult to differentiate during the fall migration. This confusion has often lead to errors in field identification, so that reports of the relative abundance and distribution of these two species during the fall migration are sometimes confusing.

The upper parts of the blackpoll are duller and more streaked, the wings are edged with a yellow-green in place of gray-green; the underparts are yellowish instead of buffy. These differences are not constant, and some individuals of the bay-breasted warbler can be distinguished only by the trace of chestnut on the flanks and under tail coverts. Perhaps the best field mark is the color of the legs, which in the blackpoll is light, approaching a yellowish, while in the bay-breasted warbler it is dark brown and in some instances almost black. It is true these warblers are more deliberate in their movements, offering better opportunities for detailed observation, but even so, positive identifications are often impossible in the field.

Concerning the postjuvenal molt and the acquiring of the fall or winter plumage E. A. Preble (1908) writes of blackpoll warblers observed and collected in the Mackenzie region of northwest Canada.

The blackpoll occurs in summer throughout the region north to the very edge of the wooded country. It arrives on its breeding ground late in May, and some individuals are on their way south again in late July, molting as they travel, into the olivaceous plumage common to old and young in autumn. * * * Birds of the year taken July 19, 23, and 29 are in the spotted juvenal plumage, but with the yellowish-green of the fall plumage [first winter] appearing on the back, throat, chest, and sides; the change was about half completed in most of the specimens. An adult taken July 26 also is molting, the yellowish-green forming a patch on each side of the breast. Took specimens in the transition from the breeding to the autumnal plumage near Lake St. Croix, August 14, when the species was abundant.

An immature female blackpoll that I collected on the mainland west of Nain, Labrador, on August 12, 1934, represents a transitional state between the juvenal and first winter plumage, with feathers of each plumage about equally represented. Another specimen, a male taken near the same place on August 18, 1937, has its winter plumage practically completed. At Lost River, in the White Mountains of New Hampshire, I have seen young in various stages of transition from the juvenal to the first winter plumage during the last week of July.

Alexander Wetmore (1936), who has made counts of the number of contour feathers of passeriform and related birds, found that a male blackpoll weighing 17.6 grams, taken October 15, 1933, had 1,583 contour feathers with a total weight of 1.2 grams.

S. P. Baldwin and S. C. Kendeigh (1938) have made the following weighings of black-polled warblers: 1 adult taken in May, 12.4 gm.; 3 males taken in September average 11.4 gm.; 1 female taken in September, 12.8 gm.; 3 immature birds taken in September average 11.5 gm.; and 4 in October average 13.9 gm.

Albinistic plumages of the black-polled warbler apparently are not rare. J. Harris Reed (1888) describes the plumage of a male taken May 12, 1888, at Upper Chichester, Delaware County, Pa., as follows:

> The entire crown, with the exception of three or four small black feathers over the eyes, is pure white, the edges of the feathers tipped with cream color which is more decided fringing the neck. The upper tail-coverts and rump are pure white, extending high up on the back and passing irregularly through the interscapulars and joining the white on back of neck and crown; rather silky across the rump. The interscapulars form an irregular bar across the shoulders. The scapulars and tertiaries are sparsely spotted with white, most prominent on the right side. The sides of breast are streaked as usual, although of a rusty color, rather obsolete as they approach the chin which is pure white. The throat and breast are ochroleucous. Otherwise the plumage is natural. * * * The white feathers are immaculate from the quills out, none being edged or spotted with the natural colors.

Charles H. Townsend (1883) states that a black-polled warbler in the Academy of Natural Sciences of Philadelphia has the entire plumage suffused with white, and William Dutcher (1888) found a perfect albino blackpoll killed by striking Fire Island light on September 23, 1887. Other cases of pure and partial albinism have been reported, indicating that this abnormality may be expected.

Food.—Anyone who has observed the blackpolls during migration and especially in their nesting haunts in the coniferous forests is well aware of their insect-feeding habits. Not only do they glean the leaves and twigs of insects and their larvae, but frequently they dart out from the concealment of the foliage to capture some passing flying insect with a sharp snap of the bill, after the manner of the flycatcher. At Kent Island, New Brunswick, I have frequently seen them on the terminal branches of the spruce trees feeding upon the spruce gall lice and other insects which infest these trees. All the food that I have seen eaten by the adults or delivered to their young during the nesting season consisted wholly of insects and spiders.

The blackpoll, like many other species of insect-eating birds, may at times neglect its usual food to take extraordinary numbers of those species which, for any reason become superabundant for a time, thus this bird serves well in doing its part to extirpate serious local infestations of insects. E. H. Forbush (1907) cites a case in which warblers completely eliminated an infestation of plant lice as follows:

> I have had several opportunities, within the last fifteen years, to watch the checking of insect uprisings by birds. One morning in the fall of 1904 I noticed in some poplar trees near the shore of the Musketaquid a small flock of myrtle and black-poll warblers, busily feeding on a swarm of plant lice. There were not more than fifteen birds. The insects were mainly imagoes, and some of them were flying. The birds were pursuing these through the air, but were also seeking those that remained on the trunks and branches. I watched these birds for some time, noted their activity, and then passed on, but returned and observed their movements quite closely all day. Toward night some of the insects had scattered to neighboring trees, and a few of the birds were pursuing them there; but most of the latter remained at or about the place where the aphids swarm was first seen, they were still there at sundown. The swarm decreased rapidly all day, until just before sunset it was difficult to find even a few specimens of the insect. The birds remained until it was nearly dark, for they were still finding a few insects on the higher branches. The next morning at sunrise I went to the trees to look for more specimens. The birds, however, were before me, I was unable to find a single aphis on the trees.

S. A. Forbes (1883) made an investigation of the food eaten by birds found in a 45-acre apple orchard, in Illinois, heavily infested with cankerworms. Of the birds collected and their stomach contents examined, four blackpolls had eaten cankerworms to the extent of 67 percent of their stomach contents. In addition there were boring bettles (*Psenocerus*), 15 percent; other Coleoptera (beetles), 4 percent; ants, 4 percent; gnats 4 percent; traces of Hemiptera and mites; and some undetermined seeds. Samuel Aughey (1878) studied the food of Nebraska birds during the great invasion of Rocky Mountain migratory locusts on the western prairies and plains during the period 1873–1876. The blackpoll was prominent among the birds which preyed upon the locusts. Of four blackpoll stomachs examined, each contained an average of 30 locusts and 12 other insects; no seeds, grains, or other food was found. Sylvester D. Judd (1902) made a special study of the birds on a Maryland farm. On May 13–15, 1900, he observed blackpolls feeding on mayflies at the top of a cedar tree so heavily infested that it was gray with these insects. On May 17 he also found these warblers doing their part in suppressing an infestation on pine trees by sawflies (*Pteronus*). The stomachs of 11 specimens collected on the farm revealed that they had also eaten freely of ants, weevils, wasps, and bees. The blackpoll warbler has been known to feed ravenously on winged termites at times when these insects appear in immense swarms. There are numerous reports that in the far north these birds devour hundreds of troublesome mosquitoes.

In fall the blackpoll eats a few seeds and berries, such as the pokeberry (*Phytolacca americana*), but they are mainly insectivorous at all seasons. When passing through Florida in autumn they devour large numbers of spiders and their eggs, plant lice, and scale insects found on the citrous and native plants. It is obvious that the blackpoll is useful as an insect-eating bird and that they often play an important role in suppressing insect infestations.

Voice.—Late in May in New England after the host of warblers have arrived and many of them have passed on their way, we may expect to hear the unpretentious, high-pitched, insectlike but characteristic song of the black-polled warbler. It is in full song when it arrives and continues to sing throughout its stay, one of the most frequently heard warbler songs at that season. Its song is not musical, but the ebb and flow of its rapidly uttered series of high-pitched, accented syllables is most agreeable. It sings on the average only two or three times a minute, and seldom more than four times a minute, but in any favorable woodland there are sure to be several individuals singing, so that the song is always in evidence. Although these birds may be well hidden by the foliage, the song always assures one of their presence, but it is not always easy to trace to its source, as it has certain deceiving ventriloquial qualities.

Aretas A. Saunders (1941) gives his analysis of the black-polled warbler's song as follows: "The song of this bird is weak, high-pitched, and much like those of the Bay-breast and Black and White in quality. The commoner form of song is a series of notes all on the same pitch and in even time, but growing louder in the middle and softer again to the end. The number of notes varies from six to eighteen, and the notes are sometimes slow and measured and at other times quite rapid. In a less common form the notes are so rapid as to be uncountable, and the song becomes a trill, swelling in loudness in the middle."

Ralph Hoffmann (1904) in describing the song writes: "It is a high thin *tsit tsit tsit tsit tsit*, of a penetrating quality, delivered with a crescendo and diminuendo; the last notes are by some birds run rapidly together with almost a sputtering effect."

Rev. J. H. Langille (1884) states: "That song, though one of the most slender and wiry in all our forests, is as distinguishable as the hum of the Cicada or the shrilling of the Katydid. *Tree-tree-tree-tree-tree-tree-tree-tree*, rapidly uttered, the monotonous notes of equal length, beginning very softly, gradually increasing to the middle of the strain, and then as gradually diminishing, thus forming a fine musical swell. * * * There is a peculiar soft and tinkling sweetness in this melody, suggestive of the quiet mysteries of the forest, and sedative as an anodyne to the nerves."

On their nesting grounds in the White Mountains of New Hampshire and at Kent Island, Bay of Fundy, New Brunswick, I have heard the full song of the blackpoll throughout the nesting season but rarely after the young left the nest. I have seen them perched in full view at the very top of a spruce or fir tree pouring forth their simple but earnest song. They have a call note, a high-pitched lisp which resembles *zeet*, and when suddenly surprised or alarmed they utter a strong chirp.

The blackpoll is usually silent in autumn, but at times it has been heard in full song late in the season, after having acquired its winter plumage. During the fall migration the diurnal note *tsit* is the commonest heard.

Though the blackpoll does not excel as a songster, its song has one characteristic which makes it stand out in marked contrast to all others. Albert Brand (1938), who determined the vibration frequencies of 59 passerine birds, found that the song of the blackpoll has the highest pitch of all the bird songs he studied. Its average frequency was 8,900, midway between C sharp 8 and D 8, or over an octave above the highest tone on the piano. The blackpoll also produced the highest avian frequency studied, 10,225, a quarter tone under E 8. The lowest frequency recorded in various songs of the blackpoll was 8,050. By comparison, the mean frequency in songs of the northern pine warbler is 4,150, the highest 5,125, and the lowest only 3,300. Indeed the song of the blackpoll is of such a high frequency that it is well beyond the range of hearing of many persons. I must admit, in recent years, I have observed the blackpoll singing and could see by its posture and the movements of its beak and throat that it was singing, but I was unable to hear the song.

Enemies.—The blackpoll is subject to the usual enemies of other woodland birds, but all these apparently exact an insignificant toll when compared to the hazards experienced during migration. In crossing the wide expanses of the Caribbean Sea from the winter quarters in South America, some of them take refuge on passing boats during bad weather, but the vast majority after battling adverse winds and storms reach the Florida and Gulf coast in a weakened or exhausted condition. C. J. Maynard (1896), who landed April 27, 1884, on a small key in the Bahamas, found great numbers of blackpolls, some of which he found dead apparently due to exhaustion. W. E. D. Scott (1890) in writing of the spring migration at Tarpon Springs in 1888 states:

> It is so rare that one finds any birds dying or dead from other than accidental causes, generally connected in some way with innovations caused by the settlement of a country, as telegraph wires, light-houses, and the like, that it seems worth while to give the following details of an epidemic. It was apparently confined, as far as I am aware, to the representatives of this species alone, and only to those individuals which visited the Anclote Keys and Hog Island. These keys are four in number, and are four miles from the main land, in the Gulf, and extend in a north and south line for about twenty-five miles. I found in late April and early May many D[*endroica*] *striata* dead, and others apparently ill unto death on these islands. * * * I picked up dead on April 29, 1888, in a short walk on South Anclote Key, upwards of twenty-five.

Scott presents no evidence of disease or cause of the so-called epidemic, and I am inclined to believe these birds were members of a late migratory wave that had met with adverse conditions and died of exhaustion.

The habit of migrating at night is indirectly a cause of great mortality when waves of these birds encounter lighthouses and lighted towers. Often very serious conditions prevail during cloudy or foggy nights when the birds, losing their bearings and attracted by the bright light, descend from their high-level flight and are dashed to death on striking some part of an illuminated tower. William Dutcher (1888) writes that of the 595 birds killed by striking the Fire Island Light on Long Island on September 23, 1887, no less than 356 were blackpoll warblers.

W. E. Saunders (1930) has reported great destruction at the Long Point Lighthouse, Ontario, on Lake Erie, during September 1929. On September 7 there were 31, on September 9, 6 and on September 24–29, 199 blackpolls that met their death by flying into the light. Similar conditions prevail along the Maine coast where during cloudy and stormy nights many warblers, including a large percentage of blackpolls, are killed.

High towers such as the Washington Monument also exact a heavy toll on night-flying birds. Robert Overing (1938) reports that in the course of an hour and a half, 10:30 p. m. to midnight of September 12, 1937, 576 individual birds, chiefly warblers and including the blackpoll, were dashed to their death. At this time the humidity ranged from 65 to 75 percent, and a mist enveloped the top of the shaft. These and numerous other instances indicate that lighthouses and towers are a great menace to a night-migrating bird such as the blackpoll. Probably more individuals meet violent death in this manner than by any other way.

I have not been able to find any record of a case of parasitism of the blackpoll by the cowbird. This, however, is to be expected as the ranges of the two birds do not greatly overlap. The cowbird is of no importance in its relation to the life of this warbler.

DISTRIBUTION

Range.—North America and northern South America.

Breeding range.—The black-polled warbler breeds **north** to northern Alaska (Kobuk River and Fort Yukon); northern Yukon (La Pierre House); northern Mackenzie (Richards Island, Fort Anderson, Blackwater River, and Hanbury River); northern Manitoba (Lac du Brochet and Churchill); northern Quebec (Bush Lake, Fort Chimo, and Indian House Lake); and northern Labrador (Nain). **East** to the coast of Labrador (Nain, Cape Aillik, and Cartwright) and Newfoundland (Fogo Island, Trinity, and St. John's). **South** to southern Newfoundland (St. John's and St. Pierre); Nova Scotia (Baddeck, Halifax, and Yarmouth); southern Maine (Calais, Waterville, and Auburn); southern New Hampshire (Tamworth and Peterborough); northwestern Massachusetts (Mount Greylock); northern New York (Mount Marcy and Leyden, rarely Slide Mountain in the Catskills); northern Ontario (Trout Lake); central Manitoba (Oxford House); central Saskatchewan (Cumberland House and Flotten Lake); central Alberta (Flat Lake, Stony Plain, and Hythe); and central and northwestern British Columbia (Summit Lake, Tatana Lake, and Atlin); southern Yukon (Carcross) and southern Alaska (Chitina Maraine, Lake Clark, and Nushagak). **West** to western Alaska (Nushagak, Bethel, St. Michael, Nome, and Kobuk River).

Winter range.—The blackpoll winters in northern South America **east** to eastern Cayenne (Oyapock River). **South** to southern Cayenne (Oyapock River); western British Guiana (Roraima); southern Venezuela (Casiquiare); northwestern Brazil (Marabitanas); and north-central Ecuador (Sara-yacu). **West** to north-central Ecuador (Sara-yacu and Archidona) and western Columbia (La Morelia, Río Frío, and the Santa Marta region).

Migration.—Late date of spring departure from the winter home is; Ecuador—Río Suno, April 10. Early dates of spring arrival are; Cuba—Habana, April 24. Bahamas—Cay Lobos, April 15. Florida—Sombrero Key, April 14. Alabama—Barachias, April 22. Georgia—Milledgeville, April 11. South Carolina—Aiken, April 20. North Carolina—Raleigh, April 16, Virginia—Lynchburg, April 18. West Virginia—Wheeling, April 31. District of Columbia—Washington, April 21. Pennsylvania—Jeffersonville, May 4. New York—Brooklyn, May 1. Massachusetts—Quincy, May 7. New Hampshire—East Westmoreland, May 2. Maine—Portland, May 7. Nova Scottia—

Halifax, May 15. New Brunswick—Fredericton, May 18. Newfoundland—Tompkins, May 17. Quebec—Montreal, May 18. Labrador—Cartwright, May 27. Louisiana—Grande Isle, April 20. Mississippi—Oxford, April 23. Arkansas—Winslow, April 22. Tennessee—Chattanooga, April 19. Kentucky—Russellville, April 25. Indiana—Bloomington, April 28. Ohio—Cleveland, April 29. Michigan—Battle Creek, April 28. Missouri—Independence, April 27. Iowa—Marshalltown, May 3. Wisconsin—Milwaukee, May 1. Minnesota—Red Wing, May 5. Kansas—Wichita, May 2. Nebraska—Red Cloud, May 1. South Dakota—Sioux Falls, May 3. North Dakota—Grafton, May 4. Manitoba—Aweme, May 6; Churchill, June 6. Saskatchewan—Regina, May 8. Mackenzie—Providence, May 16. Colorado—Boulder, May 6. Wyoming—Cheyenne, May 8. Montana—Great Falls, May 12. Alberta—McMurray, May 8. British Columbia—Tetama Lake, May 22. Alaska—Bethel, May 20.

Late dates of the spring departure of transients are: Haiti—Gonave Island, May 15. Cuba—Habana, May 16. Bahamas—Andros Island, May 23. Florida—Daytona Beach, June 1. Alabama—Long Island, May 22. Georgia—Savannah, June 3. North Carolina—Raleigh, June 3. Virginia—Norfolk, June 7. District of Columbia—Washington, June 16. Pennsylvania—Haverford, June 10. New York—Far Rockaway, June 18. Massachusetts—Harvard, June 17. Louisiana—Grande Isle, June 4. Mississippi—Deer Island, May 29. Tennessee—Nashville, June 2. Illinois—Chicago, June 9. Ohio—Cleveland, June 10. Michigan—Sault Ste. Marie, June 5. Ontario—Ottawa, June 12. Missouri—St. Louis, June 6. Iowa—Grinnell, June 10. Wisconsin—Madison, June 13. Minnesota—St. Paul, June 9. Oklahoma—Copan, June 5. South Dakota—Faulkton, June 10. North Dakota—Argusville, June 10. Manitoba—Aweme, June 24. Saskatchewan, Indian Head, June 9. Colorado—El Paso County, June 1. Wyoming—Laramie, May 26. Montana—Great Falls, June 8.

Early dates of fall arrival are: Manitoba—Aweme, August 18. South Dakota—Yankton, August 8. Kansas—Lawrence, September 18. Ontario—Rainy River, August 5. Minnesota—Lanesboro, August 27. Wisconsin—Herbster, August 10. Iowa—Wall Lake, August 28. Missouri—Montier, August 29. Michigan—Detroit, August 20. Illinois—Glen Ellyn, August 23. Ohio—Toledo, August 14. Kentucky—Danville, August 31. Tennessee—Nashville, September 8. Louisiana—New Orleans, September 21. Vermont—Burlington, August 24. Massachusetts—Boston, September 1. New York—Rochester, August 28. Pennsylvania—Berwyn, August 20. District of Columbia—Washington, August 17. Virginia—Charlottesville, August 20. North Carolina—Chapel Hills, September 16. Georgia—Augusta, September 23. Alabama—Birmingham, September 7. Florida—Fort

Myers, September 25. Bahamas—Watling Island, September 28. Dominican Republic—San Juan, September 27. Puerto Rico—Cartagena Lagoon, September 24. Barbados—October 20. Colombia—Santa Marta region, September 29.

Late dates of fall departure are: Alaska—Fort Yukon, September 18. Yukon—Macmillan Pass, September 7. British Columbia—Atlin, August 27. Mackenzie—Leith Point, Great Bear Lake, August 29. Alberta—Edmonton, September 25. Montana—Great Falls, October 3. Saskatchewan—South end of Last Mountain Lake, September 3. Manitoba—Churchill, September 6; Shoal Lake, September 26. North Dakota—Fargo, October 23 (bird banded). Nebraska—Hastings, October 16. Kansas—Lawrence, October 23. Oklahoma—Norman, November 8. Wisconsin—New London, November 4. Iowa—Davenport, October 4. Missouri—La Grange, October 13. Ontario—Ottawa, October 11. Michigan—Grand Rapids, October 29. Ohio—Youngstown, October 21. Illinois—Murphysboro, October 20. Tennessee—Nashville, October 23. Quebec—Fort Chimo, August 23; Montreal, October 6. Newfoundland—Cape Anguille, October 3. Maine—Bath, October 7. Vermont—Wells River, October 17. Massachusetts—Harvard, November 24. New York—Orient, November 20. Pennsylvania—Doyleston, November 7. Virginia—Lexington, October 28. North Carolina—Raleigh, November 6. South Carolina—Mount Pleasant, November 14. Georgia—Athens, November 1. Florida—Clewiston, November 24. Bahamas—Watling Island, November 9. Puerto Rico—Cartagena Lagoon, November 26.

Casual records.—The blackpoll has occurred several times in Greenland. In 1853, one was shot near Godthaab; a juvenile was collected in Isua Lichtenfelsfjord on October 14, 1911, and two more were taken there late in the same month; on October 15, 1911, another juvenile was shot near the Isua copper mine in the Ivigtut District; and on September 18, 1919, a juvenile was shot near Narssarmiut in the Sukkertoppen District. Several occurrences in Bermuda have been recorded: one was seen March 12 to 15, 1901; six were seen October 12, 1929; and one was seen October 21, 1929. On June 17, 1858, an adult male was collected at Collico near Valdivia, Chile. It has been surmised that this may have been an escaped cage bird.

Destruction.—Lighthouses and high buildings have, at times, taken heavy toll of the black-polled warbler and this species is nearly always on the list of those striking. At Sombrero Key, Fla., they have been reported to strike the lighthouse from April 14 to May 20 and from September 25 to November 16. The highest number striking in spring was on May 19, 1887, when 60 birds struck the light, of which half were killed. The fall migration takes a heavier toll, for on the night of October 14, 1887, 160 blackpolls struck, of which 95 were killed, and during the four nights October 14 to 17, 124 birds were killed out of 322 that struck the light. Blackpolls have been reported as seen about the light at Montauk Point, N. Y., from September 29 to October 27, but no figures are available as to the number killed. At Fire Island Light on the night of September 23, 1887, of the 595 birds that were killed, 356 were blackpolls. In the fall of 1920 many were killed around the light at Long Point, Ontario. From September 7 to 29, 236 were killed; 199 of them between September 24 and 29. More lately, on the night of September 10, 1948, four blackpolls were killed by flying against the Empire State Building in New York City.

Egg dates.—Alaska: 3 records, June 10 to 21.

New Brunswick: 38 records, June 10 to July 3; 23 records, June 12 to 20, indicating the height of the season.

New Hampshire: 11 records, June 16 to July 16; 7 records, June 20 to 28.

Quebec: 16 records, June 19 to July 4; 9 records, June 23 to 27 (Harris).

DENDROICA PINUS PINUS (Wilson)

NORTHERN PINE WARBLER

HABITS

Both Wilson and Audubon, referring to its habitat and behavior, called this bird the pine-creeping warbler, a most appropriate name; but each gave it a different scientific name. Audubon's name, *vigorsii*, which stood for many years as the specific name, has given way to *pinus*.

Except on its migrations and some of its summer wanderings, this warbler is essentially a bird of the more open pine woods. In eastern Massachusetts we have always associated the pine warbler with the pitch pines (*Pinus rigida*), with their undergrowth of scrub oak, that cover many miles of sandy barrens on Cape Cod and adjacent regions; where it is a quite characteristic and very common breeding bird. We seldom see it in the denser forests of white pines (*Pinus strobus*) that are the characteristic summer home of the black-throated green warbler. Farther north it is sometimes found breeding in them, but as a general rule it shuns them. Farther west it finds a congenial home in the jack-pine barrens. Elsewhere it frequents Norway pines, red pines, short-leaved pines, scrub pines, and other pines of similar growth. N. S. Goss (1891) writes: "This species, as its name indicates, prefers the pine trees, and usually makes its summer home in the coniferous growths. I have, however, on several occasions met with them during the early summer months in the heavily timbered bottom lands, far away from evergreen trees, and during migration and the winter months they seem to be as much at home in the deciduous trees as among the pines, often visiting the orchards and lowland thickets." Frederick V. Hebard tells me that in the Southern States it shows a decided preference for the longer-leafed pines.

Spring.—The pine warbler is one of the few North American wood warblers whose winter ranges include much of their breeding range; hence its migrations are not much in evidence, except in the northern part of its summer home. West of the Mississippi Valley and in the Great Plains region, where pine woods are scarce or absent, it occurs only as a migrant on its way to the northern pine forests. In the southeastern States it is present at all seasons, and it is an abundant migrant east of the Alleghenies, northward to New England and southern Canada. It begins to migrate from the northern boundary of its winter range during the last week in March or earlier and passes through New England mainly in April. In Massachusetts we regard it as about the earliest of our warblers, usually appearing in advance of the yellow palm or the myrtle warbler; we can always expect it early in April and occasionally before the end of March. As soon as the warm spring sun brings out the fragrance of the pine needles, and the first pink blossoms of the trailing arbutus are peeking out from under their winter covering, we may breathe the delightful odors of the pine barrens, listen to the simple trills of the pine warblers among the treetops, and look for the first of the hermit thrushes in the scrub oaks.

Nesting.—My experience with the nesting of the northern pine warbler is limited to the finding of a few nests in southeastern Massachusetts. These nests have always been in pitch pines in the dry, sandy pine barrens of Plymouth and Barnstable Counties; I have heard the birds singing in isolated groves of these pines elsewhere but have never happened to find a nest there. The nests I have seen have been placed on horizontal branches at heights varying from 10 to 25 feet above ground, for the trees are seldom very tall; a favorite site seems to be on a branch overhanging a road or path. They were usually well concealed in a cluster of pine needles, but were sometimes in plain sight from the road. The nests are well made and compact; and are usually warmly lined with small feathers, as the birds are early nesters; one especially pretty nest was beautifully lined with bluebird feathers.

Forbush (1929) describes the nests as made "of weed-stems, bark-strips, pine needles, pine twigs, caterpillars' or spiders' webs or similar material; lined with pine needles, fern-down, hair, bristles, or feathers." Nuttall (1832) found a nest of this warbler near Mount Auburn in eastern Massachusetts that was about 40 feet from the ground in a Virginia juniper, or red cedar; "it was firmly fixed in the upright twigs of a close branch. The nest was thin, but very neat; the principal material was the wiry old stems of the slender knot-weed (*Polygonum tenue*), circularly interlaced, and connected externally with rough linty fibres of some species of *Asclepias*, and blended with caterpillars' webs."

In the Carolinas, where the northern pine warbler breeds abundantly, the nests are always built in pines at heights varying from 8 to 80 feet above the ground, but more commonly between 30 and 50 feet up. Arthur T. Wayne (1910) has found nests in South Carolina as high as 135 feet in the tallest pines. The nest may be saddled on a horizontal limb, concealed in the needles at the end of the branch, or hidden in a bunch of cones near the top.

Eggs.—The pine warbler lays from 3 to 5 eggs in a set, but usually 4. These are ovate or short-ovate and are practically lusterless. The ground color is white, grayish white, or greenish white, and is speckled, spotted, or blotched with a wide variety of browns, such as "bay," "chestnut," "auburn," "argus brown," "Brussels brown," "Prout's brown," "liver brown," or "chestnut-brown," with undertones of "light brownish drab," "brownish drab," or "vinaceous-drab." The spottings are usually concentrated at the large end, where a loose wreath may be formed by numerous brown specklings, or a solid band of bold blotches or cloudings may be produced. In some cases the drab markings are the more numerous, with a few scattered spots of the darker browns or with a few scrawls of black. Occasionally, on eggs that are spotted with "Brussels brown" or "Prout's brown," the undertones may be a "buffy citrine," instead of the usual drabs. The measurements of 50 eggs average 18.1 by 13.5 millimeters; the eggs showing the four extremes measure **20.0** by 14.0, 19.1 by **14.2**, and **16.5** by **12.6** millimeters (Harris).

Young.—The period of incubation does not seem to be definitely known. Several observers have noted that the male shares with the female the duties of incubation. Both parents are industrious and devoted in the care and feeding of the young. In a nest watched by Dr. T. S. Roberts (1936), "they brought spiders and insects of various kinds, including large green larvae, caterpillars, and flies, many so small they could scarcely be seen even at close range. The supply was gathered almost entirely from among the foliage and cones of the jack-pines near by, and the birds could often be seen dragging the larvae from between the scales of the latter. The larger insects were killed and mashed by pounding them on a large limb before they were brought to the young. The parents came and went rapidly, often once or twice a minute. They sometimes fed the same bird several times in succession."

Plumages.—Dr. Dwight (1900) calls the natal down sepia-brown, and describes the juvenal plumage as "above, drab, shading to hair-brown. Wings and tail deep olive-brown the secondaries and rectrices with greenish gray edgings, the tertiaries and wing coverts edged with drab; two dull white wing bands. Below, olive-gray washed with drab on the throat and sides and indistinctly mottled with deeper gray. Orbital ring white." A partial postjuvenal molt, involving the contour plumage and the wing coverts, but not the rest of the wings or the tail, begins late in July in the north, and produces for first winter birds an entirely different plumage, in which the sexes are first distinguishable. Of the young male, Dr. Dwight says: "Above bright olive-green veiled with drab-gray edgings, the upper tail coverts grayer. Wing coverts black, edged with greenish olive-gray; two white wing bands. Below, including superciliary stripe and orbital ring bright lemon-yellow, fading to dull white on abdomen and crissum, veiled with whitish edgings, the flanks washed with drab-gray, a few concealed dusky streaks on the sides of the breast. Lores and postocular spot dusky." The first winter plumage of the female "is much browner than that of the male, being olive-brown above and pale wood brown below with scarcely a tinge of yellow."

The first nuptial plumage is "acquired by wear which is excessive, birds becoming greener above and greener yellow below by loss of the edgings, the breast streaks being also exposed." The first nuptial plumage of the female is grayer than in the fall, easily distinguishable from that of the male. Old and young birds are now practically alike, except for the duller juvenal wings and tail.

A complete postnuptial molt in July and August produces the adult winter plumages of the two sexes, much like those of the first winter, but yellower, with more streaking and less veiling, in the male and also yellower in the female, the latter resembling the first winter male. Nuptial plumages are acquired by wear, as in young birds.

Food.—A. H. Howell (1932) reports that the examination of seven stomachs of pine warblers, some of which might have been of the Florida subspecies, all taken in Florida, "showed the food to consist largely of insects and spiders, with small quantities of vegetable debris. The insects taken included grasshoppers, grouse locusts, moths and their larvae, beetles, ants and other Hymenoptera, bugs, flies, and scale insects." It has been known to eat the cotton boll weevil, aphids, and the eggs and larvae of other insects. As it obtains most of its food on the pine trees, it is evidently very useful in ridding these trees of the various insect pests that injure them, seeking them in the crevices in the bark of trunks and branches and, in the clusters of needles and under the scales of cones.

It is an expert fly-catcher, but in winter, when insects are not so easily obtained, and probably at other times to some extent, it feeds largely on vegetable food, mainly the seeds of the various pines, but also on wild fruits and berries, such as those of dogwood, wild grapes, ivy, bayberry, Virginia creeper, and sumac. It is often seen feeding on the ground probably on grass and weed seeds. Its food habits seem to be wholly beneficial.

Behavior.—The pine warbler is normally quite deliberate in its movements, as it creeps in a leisurely manner over the trunks and larger branches of the pines, searching for insect eggs or larvae in the crevices in the bark. It clings to or climbs over the trunks as easily as a brown creeper, and explores the bases of the needle clusters or hangs from them in the manner of a titmouse. It is quite lively at times, as it flies from the top of one tree to another, sometimes for a long distance, or as it darts out into the air after a passing insect. It frequently feeds on the ground, picking up seeds, grubs or insects; Ridgway (1889) says that "when on the ground it progresses by a graceful gliding walk, much after the manner of the Red-poll Warbler (*D. palmarum*)." If disturbed while feeding on the ground, it flies up and clings to the trunk of the nearest tree; but it is usually rather tame and approachable. On its breeding grounds it is almost constantly in song, flying about from tree to tree, and where it is common, the voices of several may be heard in various directions. R. E. Stewart (1943) writes:

> In late August and September, following the breeding season, these birds show a drastic change in habits and frequently occur in small flocks around the headquarters buildings. Here they generally may be found associating with Bluebirds (*Sialia sialis*) and Chipping Sparrows (*Spizella passerina*), feeding on the ground as well as in the bushes and trees of the orchards and landscaped areas. While watching these mixed flocks it was noticed that the Pine Warblers were extremely quarrelsome, frequently fighting among themselves, as well as giving chase to Bluebirds, Chipping Sparrows and, on one occasion, a Vesper Sparrow (*Pooecetes gramineus*).

Voice.—Aretas A. Saunders contributes the following study: "The song of the pine warbler is a short trill or series of rapid notes. It is not loud but is quite musical and pleasing in quality. The notes are rarely all on one pitch but vary up or down a half tone. The number of notes, in those songs in which the separate notes are distinct, varies from 8 to 27, averaging 13. A few songs are made up of a single trill, that is, the separate notes so rapid that they cannot be counted.

"Of my 17 records of this song, only 2 are all on one pitch, the remainder showing variation. This slight variation in pitch is one of the characters of this song that distinguishes it from chipping sparrows, juncos, or other species that sing a simple trill. The pitch in my records varies from A''' to E'''', a range of three and a half tones. Single songs rarely vary more than a tone and a half. Songs vary in length from 1 to 2⅗ seconds.

"I have noted no difference that is definite between the songs of migrating birds and of those on breeding grounds. I have no definite data on the song period, but in the New Jersey pine barrens birds are still in song in the middle of July."

In New England, pine warblers sing more or less all summer and up to the middle of September or a little later. Francis H. Allen, who has heard one singing while feeding on the ground, tells me: "The ordinary song is, of course, a simple, sweet, liquid trill, but not infrequently I hear a song consisting of two trills, the second pitched lower than the first. On April 18, 1932, at Pembroke, Mass., I heard from a pine warbler a number of times a slow *wip wip wip wip wip*, etc., followed sometimes by the rapid trill of the ordinary song. And on April 17, 1935, at Westwood, Mass., I found several singing in white pine woods with a good deal of variety in rapidity and pitch, and sometimes a downward inflection at the end of the trill. I have noticed on two or three occasions that when the bird sings the bill is opened and closed with each note of the trill and the bird quivers all over, fluttering the wings very noticeably.

"I have heard from a young bird in August a confused, lisping song, warblerlike but not at all like the regular song of the species. From young birds in September I have heard a chatter, while they were being fed, that ended in a heavy note; I recorded it as *tip tip tip tip sip*. The call-note resembles that of the black-poll warbler but, as I have heard it, seems somewhat more prolonged and fainter. Another is a sharp, high *chip* or *tip*, lighter and clean-cut."

Albert R. Brand (1938) records the number of vibrations per second in the song of the northern pine warbler as varying from 5,125 to 3,300, with an approximate mean of 4,150. The latter is the lowest figure for any of the Dendroicae.

Enemies.—The pine warbler seems to be a rare victim of the cowbird; I have been able to find only seven records in the literature.

Harold S. Peters (1936) lists only one tick, *Haemaphysalis leporis-palustris* Packard, as an external parasite on this warbler.

Field marks.—The adult male has a bright greenish-yellow breast, greenish-olive upper parts, two whitish wing bands, and white patches at the ends of the two outer tail feathers. The female is duller throughout, with less yellow on the breast. Both sexes are duller and more brownish in the fall. Young birds are very plainly colored, with no bright colors, and are decidedly brown above, but the dull whitish wing bands and white markings in the tail are good field marks.

Winter.—As the pine warbler spends the winter in approximately the southern third of its breeding range, it becomes exceedingly abundant in the southern States at that season. A few hardy individuals occasionally remain in winter as far north as Massachusetts, but the great majority join the resident birds from Virginia and southern

Illinois southward to Florida and the Gulf States. Dr. Chapman (1907) writes: "The pine barrens of Florida have no more characteristic bird than this abundant Warbler. Even on frosty mornings one may hear its trilled monotone rising distinctly above the accompaniment of Palm Warbler *chips*, Bluebird whistles, and Nuthatch chatter. By February 1 they are singing in numbers and to one who is much in the pines, their voice becomes as much an audible expression of the mood of the trees as the sighing of the wind through their branches."

N. S. Goss (1891) says that in Kansas during the winter months, "they seem to be as much at home in the deciduous trees as among the pines, often visiting the orchards and lowland thickets. I found a few wintering in the cypress swamps in eastern Arkansas, also in Florida, where they are quite common, and usually in small flocks."

Referring to the sandhills of North Carolina, Milton P. Skinner (1928) writes: "During the winter these warblers are found in little groups of from two to six individuals. Sometimes a single bird is seen, but when that is the case it is almost always with other birds such as Myrtle Warblers, Juncos, Hermit Thrushes, Bluebirds or White-throated Sparrows. * * * On January 15, 1927, several were seen foraging amid the fallen leaves and pine straw at the edge of a scrub oak forest. Here they tore old oak leaves apart and devoured the eggs and young of gall insects."

DISTRIBUTION

Range.—Southern Canada, the eastern United States and the Bahamas.

Breeding range.—The pine warbler breeds **north** to central Alberta (Athabaska and Flat Lake; possibly Lac la Biche); central Saskatchewan (Wingard); southern Manitoba (Aweme and Winnipeg); southern Ontario (Rainy River, upper Michipicoten River, Algonquin Park, and Ottawa); and southern Quebec (Inlet P. O., Montreal, and Chambley); it has also occurred but without evidence of breeding in southeastern Quebec (Esquimaux Bay); Prince Edward Island; and New Brunswick (Grand Manan and Fredericton). **East** to southeastern Quebec (Chambley); central southern Maine (Bangor and Bucksport); and the Atlantic coast south to southern Florida (Miami and Homestead); also the Bahamas. **South** to southern Florida (Homestead and Long Pine Key); the Gulf coast of Florida, Alabama, and Mississippi to southern Louisiana (Madisonville and Bayou Bara); and southeastern Texas (Sour Lake and Conroe). **West** to eastern Texas (Conroe, Waskam, and Texarkana); southeastern Oklahoma (Broken Bow and Wilburton); eastern Kansas (Hesston and Bendena); northeastern Illinois (Riverside); southwestern Wisconsin

(North Freedom); north and central Minnesota (Mille Lacs, Gull Lake, and Itaska Park); southern Saskatchewan (Indian Head); and central Alberta (Castor and Athabaska).

Winter range.—The pine warbler winters **north** to northwestern and central Arkansas (Rogers and Hot Springs); central Mississippi (Deemer); north-central Alabama (Birmingham); north-central Georgia (Atlanta); northern South Carolina (Chester); central North Carolina (Charlotte and Raleigh); and southeastern Virginia (Lawrenceville). It has occurred casually in winter north to Memphis and Knoxville, Tenn.; Summersville, W. Va.; Geneva, N. Y.; Morristown, N. J.; and Framingham, Mass. **East** to southeastern Virginia (Lawrenceville); eastern North Carolina (Roanoke Island and Lake Mattamuskeet); the coast of South Carolina (Charleston); Georgia (Savannah); and Florida (St. Augustine, Miami, and Homestead). **South** to southern Florida (Homestead); the Gulf coast of Florida (St. Marks and Whitfield); Mississippi (Biloxi); Louisiana (New Orleans and Chenier au Tigre); and Texas (Houston and Cameron County); and there is a single record for northeastern Mexico (Matamoras).

The range as outlined includes the entire species, of which two races are recognized on the continent of North America. The northern pine warbler (*D. p. pinus*) occupies all of the range except the southern part of the peninsula of Florida where, from Volusia, Lake, and Citrus Counties southward, it is replaced by the resident Florida pine warbler (*D. p. florida*). Other races occur in the Bahamas.

Migration.—Early dates of spring arrival are: Alabama—Shelby, March 18. Virginia—Lynchburg, February 25. District of Columbia—Washington, March 5. Pennsylvania—Swarthmore, March 15. New York—Orient, March 23. Massachusetts—Boston, March 28. New Hampshire—Concord, April 3. Maine—Lewiston, March 30. Quebec—Montreal, May 6. Tennessee—Athens, February 22. Kentucky—Berea, March 29. Missouri—St. Louis, April 11. Illinois—Riverside, April 7. Indiana—Indianapolis, April 17. Ohio—Columbus, March 29. Michigan—Grand Rapids, April 16. Ontario—Toronto, April 13. Iowa—Sabula, April 17. Wisconsin—Reedsburg, April 19. Minnesota—St. Paul, April 17. Manitoba—Aweme, April 17.

Late dates of fall departure are: Manitoba—Aweme, September 25. North Dakota—Fargo, September 18 (bird banded). Minnesota—Hutchinson, October 15. Wisconsin—Trout Lake, October 11. Iowa—Lamont, October 1. Missouri—St. Louis, October 24. Ontario—Ottawa, October 10. Michigan—Ann Arbor, October 25. Ohio—Toledo, October 22. Indiana—Washington, October 27. Illinois—Olney, October 23. Kentucky—Versailles, October 20. Quebec—Montreal, October 18. Maine—Portland, October 17. Vermont—Wells River, October 6. Massachusetts—Martha's Vineyard, November 23. New York—New York, October 29. Pennsylvania—Philadelphia, November 6. Delaware—Dover, November 28. District of Columbia—Washington, October 31. Virginia—Charlottesville, October 22.

Banding.—At Thomasville, Ga., among several wintering pine warblers trapped in January and February 1924, was one that had been banded there the previous year. Several pine warblers banded in Massachusetts have yielded data on longevity: A pine warbler banded at North Eastham on Cape Cod on August 4, 1931, was retrapped at the same station, April 16, 1934; another banded September 1, 1934, was retrapped at the same station on May 27, 1939; another banded at this station on September 7, 1934, was killed by an auto on June 20, 1939, nearby. A pine warbler banded at East Wareham, Mass., on April 16, 1926, was retrapped at the same station on March 29, 1929, and April 9, 1932, being at least six years and nine months old when last seen.

Casual records.—A juvenile was shot at Godthaab, Greenland, on October 1, 1899. There are several records of the occurrence of the pine warbler in Bermuda, usually in small flocks. They were found in the islands September 27, 1849; October 5, 1850; October 15, 1850; March 16, 1875; and October 4, 1930. On October 16, 1930, one came aboard a ship about 100 miles off Cape Hatteras.

Egg dates.—Florida: 23 records, April 8 to May 26; 13 records, April 11 to 27.

Massachusetts: 18 records, May 22 to June 28; 10 records, May 23 to 31.

New Jersey: 23 records, May 9 to June 21; 13 records, May 13 to 30, indicating the height of the season.

North Carolina: 9 records, April 4 to May 1; 5 records, April 14 to 23.

DENDROICA PINUS FLORIDA (Maynard)

FLORIDA PINE WARBLER

PLATE 49

HABITS

C. J. Maynard (1906) described this subspecies as the resident form of southern Florida, from Volusia, Lake, and Citrus Counties to Homestead and Long Pine Key in the southern Everglades. It has a longer bill and the upper parts are slightly more yellowish. It is evenly distributed in the extensive pine forests throughout its range. Arthur H. Howell (1932) says that—

nesting begins late in March or early in April. Nicholson observed two nests in process of construction at Orlando, March 12, 1911, one 30 feet up in a cypress tree, the other 40 feet up in a pine. In the same locality, on April 18, he found a nest containing 4 eggs, 30 feet up in a pine, and 10 feet from the trunk at the end of a branch. The nests are usually near the tips of slender limbs and well concealed in clumps of leaves or bunches of cones. They are deeply cupped, constructed of grass and plant down, with a few pine needles, and neatly lined with thistle down. * * * Examination in the Biological Survey of the stomachs of 7 specimens taken in Florida showed the food to consist largely of insects and spiders, with small quantities of vegetable debris The insects taken included grasshoppers, grouse locusts, moths and their larvae, beetles, ants and other Hymenoptera, bugs, flies, and scale insects.

The eggs of the Florida pine warbler are similar to those of the northern bird. The measurements of 12 eggs average 18.0 to 13.6 millimeters; the eggs showing the four extremes measure 19.0 by 13.1, 18.2 by 14.2, and 16.9 by 13.1 millimeters (Harris).

DENDROICA KIRTLANDII (Baird)

KIRTLAND'S WARBLER

PLATES 50–52

CONTRIBUTED BY JOSSELYN VAN TYNE

HABITS

Kirtland's warbler was not described until 1852; yet the earliest scientific specimen was collected by Dr. Samuel Cabot, Jr., aboard ship near Abaca Island of the Bahamas in the second week of October 1841. Cabot, however, was on his way with John L. Stephens to Yucatán, and he became so preoccupied with his studies of the spectacular tropical birds of a country then entirely untouched by ornithologists that the little Bahaman warbler skin, brought back to Boston and deposited in his collection, remained unnoticed for more than 20 years (Baird, 1865).

On May 13, 1851, Charles Pease at Cleveland collected a male of the still unnamed warbler and gave the specimen to his father-in-law, Jared P. Kirtland, the well-known naturalist. A few days later, Spencer F. Baird, returning to Washington from a scientific meeting in Cincinnati, stopped a day in Cleveland with his friend Kirtland and was given the specimen to take back to the Smithsonian Institution (see Dall, 1915, p. 264). The next year (1852) Baird published his description of the new warbler, naming it *Sylvicola kirtlandii* in honor of Dr. Kirtland, "a gentleman to whom, more than [to] any one living, we are indebted for a knowledge of the Natural History of the Mississippi Valley."

In the following 27 years, five more specimens, four in Ohio and one in southern Michigan, were taken, all during spring migration. Then on January 9, 1879, Charles B. Cory, collecting a specimen on Andros Island of the Bahamas, discovered the winter home of the species. The location of the breeding ground, although many guesses were made about it, remained unknown until 1903, when E. H. Frothingham, of the University of Michigan Museum, and T. G. Gale went trout fishing in Crawford and Oscoda Counties in north-central Michigan. There, on the jack-pine plains, they found numbers of an unfamiliar warbler in full song. They preserved one collected by Gale, and when they returned to Ann Arbor, Norman A. Wood identified it as the still little-known Kirtland's warbler. Wood immediately went north to investigate; on July 8 he found a nest with two young and one egg and on July 9 a nest with five well-grown young (Wood, 1904).

Kirtland's warbler proved to be restricted to the fairly dense stands of young jack-pines (*Pinus banksiana*) that spring up after forest fires. The exact environmental requirements have not been definitely determined; they include a stand of small trees, predominantly jack-pines (though a considerable number of small oaks and other deciduous trees may be scattered among them) and a fairly thick ground cover—usually made up of blueberry (*Vaccinium myrtilloides*), aromatic wintergreen (*Gaultheria procumbens*), bearberry (*Arctostaphylos uva-ursi*), sheep laurel (*Kalmia angustifolia*), sweet fern (*Comptonia peregrina*), or various combinations of these. The warblers first appear in this cover 9 to 13 years after a fire, when the new pines may be barely 5 feet high. The nesting warblers usually occur in very loose colonies varying from a few pairs to hundreds, but isolated pairs have sometimes been found. As the pines grow, they increasingly shade out the ground cover; after 6 to 12 (rarely 15) years, when the pines have become 12 to 18 feet high, the habitat is no longer used by the warblers. A thick, even stand of pines becomes unattractive to Kirtlands sooner than a thin or uneven stand.

Courtship.—Up to the present, apparently, nothing about the courtship of Kirtland's warbler has been published. Verne Dockham, who has watched and recorded the arrival of Kirtlands in Oscoda County for 11 years, believes that the warblers are paired when they arrive on the breeding ground. At least, he reports, he always finds a female with each "first-arrival" male.

On June 8, 1945 (a very late season), northeast of Red Oak, Oscoda County, I watched a pair on their territory all day. The female spent much of her time on or near the ground, apparently searching for a nest site. (Actual construction of the nest began early in the morning, June 10.) The pair kept close together most of the time, with the female—who searched all parts of the chosen area, even the very edge—usually in the lead. The male made a few long flights from one side to the other of the territory, which was roughly circular, measuring 195 yards from north to south and 212 yards from east to west. A number of times (always in the immediate vicinity of the female) the male performed what seemed to be a courtship or display flight. This began at a height of 6 or 8 feet and was made with rapidly beating wings. It was a slow, slightly descending flight, usually carrying the bird directly over the female.

The male sang steadily except on the infrequent occasions when he participated, briefly, in the search along the ground for a nest site. Several times he drove from his territory the males of three adjoining areas. Once this led to a melée of three birds—the intruding male and both birds of the pair I was following—but the action was so fast that I could not tell whether the female took any active part.

Nesting.—The nests are usually very well concealed in the ground cover, often completely arched over by vegetation, with entrance from one side only. They are almost always placed within a few feet (commonly within a few inches) of a jack-pine; occasionally, though still among pines, they are in quite open situations. They are always built directly on the ground and are usually made of dead grass and other such fibrous vegetable materials. Sometimes they are lined simply with finer grasses, but commonly with red sporophyte stalks from moss or with white deer hair. They measure 40 to 45 millimeters inside depth and 48 to 55 millimeters inside diameter.

The nest is constructed entirely by the female, but the male is always nearby and seems to follow the work closely. As Axtell (1938) observed, the approach of a female with nest material is "invariably heralded by a resumption of song on the part of the male." Between June 10 and 13, 1945, near Red Oak, Harold Mayfield and I watched the entire building of a nest. The female (who had searched the whole territory most of the day on June 8) began investigating the site a half hour after sunrise. An hour later she brought what was quite surely the first piece of nest material. Except for short periods devoted to feeding, she worked hard through the remainder of the day, obtaining most of the material at certain favored spots 50 to 70 feet from the site. She made 131 trips that day and 59 on the following, thus completing the main structure of the nest. On the third day she made 7 trips, and on the fourth day 6 trips, for the lining (a total of 203 trips with nest material). The first warbler egg was laid on the fifth day (June 14) about an hour after sunrise.

Unless normal routine is disturbed by a cowbird, the eggs are laid in the early part of the morning and on successive days. Incubation, performed by the female alone, begins with the laying of the third egg. The male brings food for the female at intervals, and she commonly leaves the nest at his approach, meeting him in a nearby pine and fluttering her wings like a young bird. As incubation progresses, the male sometimes comes to the nest to feed his mate. When flushed from the nest, the female usually flutters along the ground in an "injury feigning" display. Incubation routine seems to consist of 10- to 15-minute periods of absence from the nest, alternating with periods of an hour or more on the nest (extremes: absent, 4 to 23 minutes; on the nest, 48 to 112 minutes).

Eggs.—There are usually four or five eggs in a set. Most nests reported with 3-egg sets probably contain incomplete clutches or have been raided by cowbirds; many such nests contain one to three cowbird eggs. The eggs of Kirtland's warbler are ovate to short ovate and are rather variable in color and pattern. They are creamy white or slightly pinkish white, speckled and blotched with "fawn color" and "wood brown." Occasionally the markings are rather uniformly distributed over the whole surface, but usually there is a concentration of markings in a wreath or cap about the larger end. In spite of this great range in markings, cowbird eggs can be distinguished from them by their larger size, more bluish ground color, and the fact that the two ends are marked alike. The eggs of Kirtland's warbler usually measure about 18.5 by 14 millimeters; extremes recorded are: **19.25** by 14.75; **18.0** by 14.75; 18.5 by **15.0**; 18.5 by **14.0** millimeters

Young.—The incubation period is reported by Verne Dockham as 14 days and by L. H. Walkinshaw as 14 to 15 days. My extreme dates for young on the nest are June 9 (1944) and July 17 (1930), but most dates of hatching come between June 11 and June 20. Hatching ordinarily occurs in the early part of the day. The female carries away the eggshells. During the first day or two, the female may stay on the nest much of the time and give to the young the food that the male brings; later both parents feed the young directly. Frequently a male is observed that makes more trips to the nest than the female does. When disturbed at a nest with young, both parents give quite elaborate "injury feigning" displays. The young normally remain in the nest 12 to 13 days. Only one brood is raised, but a second nest is built if the eggs or small young in a first nest are destroyed.

Plumages.—The natal down is "hair brown." The juvenal plumage was described by N. A. Wood (1904) as follows:

> Above dark slate color, lighter on the head, each feather tipped with light sepia brown; those of the mantle broadly edged with whitish spots; those of the back, with buffy white; wings and tail dark, slightly edged with light brown; * * * lesser and middle coverts * * * like the back; * * * greater coverts broadly edged with buffy brown, making distinct bars; lores, sepia brown; sides of head otherwise similar in color to the upper parts, but rather paler, fading gradually into pale buffy brown on the chin and throat, this

gradually changing to light brown on chest, sides and flank; each feather of the chest and sides with a dark center, widening at the tip, giving a distinct striped effect; abdomen, pale buffy, tinged with yellow.

Early in July the young begin to molt into the first winter plumage, which is apparently similar in the two sexes and is much like the winter plumage of the adult female, except that the young's breast is heavily speckled. This molt does not affect the flight feathers, but the body plumage is completely changed. Wayne (1904) reports collecting an immature male in South Carolina with molt not yet entirely completed on October 29. The prenuptial molt takes place "late in February, and the new plumage is assumed by March 10" Maynard (1896). However, Bonhote (1903) described a male taken March 25 on Little Abaco, Bahamas, as "undergoing a thorough moult of the head and throat." The prenuptial molt involves most of the body plumage but is less complete in first-year birds than in adults. First-year males in May and June show a mottled appearance above, with fresh bluish feathers on the crown and sides of the head and old grayish feathers on the nape and back. Males in their first breeding season are usually distinguishable, even in the field, by the paler yellow of the under parts and the presence of a speckled band (sometimes very faint) across the breast. The type specimen is a first-year male, and Baird (1852), with remarkable acumen, noted that it was "not quite matured." Maynard (1896) described this distinctive first breeding plumage of Kirtland's warbler, but his description has been completely ignored, and the statement is generally made that *Dendroica chrysoparia* (golden-cheeked warbler) is the only *Dendroica* requiring two years to reach the adult plumage. Adults have a complete postnuptial molt (which may begin as early as July 4).

Food.—Kirtland's warblers feed mainly in the small jack-pines among which they nest, but they also hunt insects in the little oak trees among the pines, usually remaining 3 to 8 feet up, and often flying out from a tree to catch an insect on the wing. Sometimes they feed on the ground (especially in the dense pine thickets where the ground is nearly bare) and sometimes in the tops of tall jack-pines, fully 50 feet from the ground. However, one seen near the tops of tall pines is usually a singing male and is perhaps not there primarily in search of food.

N. A. Wood (1904) reported that the food of the Kirtland on its nesting grounds "seemed to be span-worms, living upon jack pines, and a small light-colored span-worm moth." He "saw the warblers capture these moths during flight," and he shot a male Kirtland that had a deer fly in its mouth. Leopold (1924) wrote: "The food consists largely of centipedes, worms, and caterpillars. However, the birds also eat deer [flies] and horse flies, grasshoppers, crickets, white and dusky millers, with relish. . . . The birds also eat or drink the white pitchlike fluid which exudes from the branches of the pine."

My own observations indicate that the Kirtland's food consists of several kinds of Lepidoptera (adults and larvae), tabanid flies, winged ant-lions, small Orthoptera, and other insects. The young are first fed principally on little green and little reddish caterpillars, but after a few days, moths, adult ant-lions, and other winged insects are brought to them. Feces are usually eaten (by both parents) in the first days, later carried away.

Food is apparently very easy to get in the Michigan jack-pine country. In fact, we can probably say that, within the breeding area of this warbler, food supply is never a critical factor. Parents feeding young will often do much of their hunting within 30 or 40 feet of the nest. It is even common to see a warbler leave the nest after feeding, pick up some insects within a yard or two of the nest, and turn back immediately to feed the young again.

Kirtland's warblers have apparently never been seen drinking water, and they refuse water offered to them experimentally near the nest. However, as Leopold noted, they sometimes take drops of liquid pitch from the surface of jack-pines, and I have seen one eagerly pick up and eat drops of black automobile lubricant it found on a twig near its nest.

Behavior.— C. J. Maynard (1896) reported that Kirtland's warbler is a shy bird while in its winter range in the Bahamas, but all observers comment on its tameness in the Michigan nesting area. However, there is great individual variation. Some nesting pairs are much tamer than others, and it is common to find one member of a pair definitely tamer than its mate. Leopold (1924) found the males of two pairs much tamer than the females, and one male actually ate from his hand. L. H. Walkinshaw found a very tame female at a nest, with eggs, near Red Oak on June 21, 1932. As he lay on the ground near the nest, the bird hopped around on him and even allowed herself to be caught in his hand and banded. Her mate would not come near. Southeast of Mio in June 1944, I had similar experience with a female warbler. The bird frequently alighted on me as I inspected the nest, and if I found her on the nest when I wanted to examine the young, I usually had to push her off with my finger. She not only hopped about on the nesting-area map, which I once laid on the ground near by, but she even hopped into my open box of bird bands, picked up a string of bright yellow celluloid bands and flew up into a tree with them.

A very noticeable characteristic of Kirtland's warbler is its habit of "wagging" its tail (actually, the tail is jerked downward and then—

more slowly—returns). The mannerism is more pronounced when the warblers are disturbed or excited, but it is quite conspicuous at all times.

Although they nest in a very dry habitat, often miles from any surface water, they nevertheless take water-baths. One June 21, 1944, an hour after sunrise, I watched a male about 6 feet up in a small oak among the pines take repeated baths by splashing among the heavily dew-laden leaves—singing in the intervals between baths. (The temperature was 47° F.) He finally flew over to a jack-pine and began to shake himself and preen his feathers—still singing at regular intervals.

On June 15, 1943, about 3 hours after sunrise, I watched a female sun bathe. Perching about 5 feet above the ground on the southeast side of a small jack-pine, she tilted her body sidewise, fluffed her feathers, and thus basked in the sun for a minute or two.

Voice.—Song is an important factor in this warbler's life and also in our efforts to study the species. The males sing so loudly and so persistently that they are easily found even in the thick cover they usually frequent. Fortunately, Axtell (1938) has published a good account of the song and of the warbler's habits while singing. He writes:

> Even at * * * the nest-building season, there were frequent periods * * * when no sound was heard for several minutes from * * * the six or more males. If any one individual was observed constantly for some time, it was noted that there were frequent intervals of silence * * * even in the early morning. * * * After a period of silence lasting from half a minute to an hour or more, a bird might sing two or three repetitions of its song or might remain vocal for more than half an hour. During the singing period the song, itself less than two seconds in length, was commonly repeated with considerable regularity at intervals of from eight to twelve seconds. But here, also, some irregularities might frequently be injected. * * *
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> At this season, each male did a great deal of his singing while patrolling his territory, sometimes alone, at other times accompanied by his mate. Her presence or absence on these tours did not seem to determine whether or not he sang. I observed one singing from a stick within a foot of the ground and another nearly fifty feet up in the tip-top of one of the tallest trees in his territory. The greater part of the singing was done from the branches of the dense growth of ten-foot-high jackpines, perhaps several songs from one branch and only one song from the next, while the bird fed between. One individual interspersed preening with rather evenly timed singing while perched nonchalantly almost within arm's reach of me. Any dead tree, rising above the level of the pinetops, seemed often to influence a bird to perch and sing from one of its higher branches, sometimes for several minutes, whether the tree were near his nest or in the farther reaches of his territory. On a later trip through the same part of his domain, the bird might choose to do his singing from a different dead tree nearby, or might ignore such high perches in that vicinity until a later round.

It is remarkable how persistently the males will sing in spite of all sorts of unfavorable factors. On a clear day at the height of the season they may begin singing as much as 40 minutes before sunrise, and they may sing until sunset. They will sing in spite of temperatures as low as 25° F., and even a pouring rain may not stop them. They sing wherever they are—in the trees, on the wing during a flight from one tree to another (though their mouths may be full of insects they are taking to the young), on the ground (though this is rare), and even on a perch within a foot of their nest and young. When singing most steadily, they commonly repeat the song about seven times a minute. Early in the morning I have counted, during such singing, 237 to 250 songs per hour.

None of the various syllabifications that have been used to describe the song is very satisfactory. Perhaps this is not remarkable, for (as shown by the sound-film record made by the Cornell party) there may be more than 100 up or down slurs in one second, and pitch changes of several tones in less than one-hundredth of a second. Axtell (1938) very rightly compared the song with that of the northern waterthrush (*Seiurus noveboracensis*) and the house wren (*Troglodytes aëdon*), saying that they "are the most likely sources of confusion" in the identification of Kirtland's warblers by song. "The Water-thrush's song starts high and descends; the Kirtland's starts low, goes higher, and may end either high or low. As compared with the wren, the warbler's song is shorter, of fewer notes, and has a more definite beginning and ending." "The *loudness* of the song is one of its most outstanding characteristics. In the bird's desolate jack-pine haunts it may be heard from a quarter to a half mile. Its liquid, bubbling quality, and its lively, emphatic manner of delivery seem to be invariable features." Axtell adds that the Kirtland has the lowest-pitched song of any of the eastern Dendroicas.

I have sometimes noticed a Kirtland change his style of song, but only rarely after the early part of the season. Most individuals have quite characteristic songs, and after spending a few days in a given area of the nesting range, one can recognize by his song the owner of every territory within earshot.

A strange characteristic of Kirtland's warbler is its habit of singing incomplete songs. Occasionally a song will be broken off abruptly at any point and for no apparent reason. Sometimes an incomplete song is followed almost immediately by a complete one.

Rarely I have found a male that has an extremely aberrant song—quite unrecognizable as that of a Kirtland. Two males that I noted in Oscoda County (June 16, 1941, and June 6, 1944) had songs that were harsh, completely unmusical "rattles," reminding me somewhat of a cowbird. Another male (noted June 1, 1945) gave a simple trill very like that of the field sparrow (*Spizella pusilla*) except that it suddenly increased in speed toward the middle and dropped slightly in pitch near the end.

Kirtland's warblers usually scold very little unless the provocation is great. They use a note for scolding described by Axtell (1938) as varying from *tsyip* to *tshyook*, and like the "common scolding note of the Oven-bird" (*Seiurus aurocapillus*). Adults use a low *churk* to arouse the nestlings at feeding time. On the Kirtland's wintering grounds in the Bahamas, Maynard (1896) heard only a "harsh chirp."

Unlike many warblers, this species continues to sing throughout the incubation period and even while raising the young. However, most individuals have stopped entirely, or almost entirely, by mid July; late records are July 24, 1939 (Verne Dockham, Oscoda County), and August 1, 1932 (Leonard Wing, Crawford County).

Field marks.—Kirtland's warbler is a large, rather slow-moving warbler, described by Peterson (1939) as "gray above and yellow below, with some large sparse spotting on the breast and sides. * * * The bird *wags* its tail much like a Palm Warbler; no other *gray-backed* Warbler has this habit." (As previously noted, the "wagging" is an up-and-down motion.) After their first winter, the two sexes are easily distinguished even in the field; males, especially if fully adult, are more blue above than females, and the black in front of their eye and about the base of their bill (absent in females) always gives the appearance of a dark mask. Kirtland's warblers are usually discovered by hearing the song, and a study of Axtell's excellent description (1938) should enable an observer with previous experience of bird song to recognize a Kirtland readily.

In fall, even the adult plumage is very brown above, and all plumage markings are less distinct; few people are able to identify a fall-plumaged Kirtland in the field.

Enemies.—There have been oddly contradictory statements about the adverse factors in the life of Kirtland's warbler. In his first paper on the species, N. A. Wood (1904) mentioned the fires that sweep the jack-pine plains, and in a later paper he (1926) stated that "fire is without doubt the greatest menace to the Kirtland warbler colonies, since it destroys the habitat as well as the nests of the birds." It is, of course, quite true that a fire, if it occurs in their breeding area before mid July, will destroy the nests in its path. However, since this warbler nests exclusively in the dense stands of jack-pine that spring up after a fire, one can truly say that fires are the Kirtland's greatest need. Not only do fires in the older jack-pine stands result in suitable nesting conditions, but fires that occur in areas largely covered with red and white pine (never inhabited by the Kirtland's) promote the spread of jack-pine. Completely successful fire prevention can actually extirpate Kirtland's warbler from a given region—as happened recently in Alpena and Kalkaska Counties.

Leopold (1924, p. 57) was probably correct in considering the cowbird the most important enemy of Kirtland's warbler. As indicated, a very large number of Kirtland nests are parasitized by the cowbird; frequently the competition is too great, and the warbler young do not survive. However, there seems to be no reason to share Leopold's fear that the cowbird "may soon" exterminate this warbler. It is probable that the major changes that have been observed in the number of Kirtland's are the result of changes in the amount of suitable habitat in Michigan or in the Bahamas.

I have seen a female cowbird spend hours apparently watching a female Kirtland building a nest. The nest was entirely unguarded when the warbler was not actually working on it, and as soon as the main structure was finished—even before the lining was added—a cowbird (presumably the one that had been watching the nest-building) came early in the morning and laid in it. After watching many hours at recently completed, or nearly completed, Kirtland nests, I would judge that cowbirds laying in a Kirtland's nest during this early part of the cycle, which is the period most favorable for the cowbirds' chances of producing young, run very little risk of detection and attack. But after the warbler has begun incubation, the nest is rarely left unguarded, and the female warbler will attack violently and drive away any cowbird she finds in the vicinity.

The only predator I have actually observed to kill a Kirtland's warbler is the sharp-shinned hawk (*Accipiter striatus velox*), although the conditions were not natural in that instance, for the warbler was in a trammel net. However, this hawk, as well as Cooper's hawk (*Accipiter cooperi*) and, more frequently, the marsh hawk (*Circus cyaneus hudsonius*), occur regularly in the habitat of Kirtland's warbler, and they undoubtedly take an occasional warbler. Crows (*Corvus brachyrhynchos*) and blue jays (*Cyanocitta cristata*), common in jack-pine areas, presumably rob the nests of this warbler as well as of other birds. Red foxes (*Vulpes fulva*), red squirrels (*Sciurus hudsonicus*), spermophiles (*Citellus tridecemlineatus*), and masked shrews (*Sorex cinereus*) are potential mammal enemies that occur regularly in the warbler habitat. I have some reason to attribute a few cases of nest destruction to red squirrels or to spermophiles. Nesting female Kirtland's, under observation from a blind, have shown great excitement at the approach of a shrew, and have attacked it and driven it away.

Ants seem to be a serious enemy of the nestlings. The parents, especially the female, pay much attention to guarding the young against ants and can be seen frequently picking the ants from the nestlings' bodies. If parent birds are kept away from a nest for more than a few minutes when the temperature is fairly high and the ants active, the biting ants cause the young to squirm and jump about violently. Ants collected from a Kirtland's nest near Clear Lake, Montmorency County, June 27, 1935, were identified by Frederick M. Gaige as *Crematogaster lineolata.* Kirtland's warblers seem to be very free of external parasites. It is rare to find even Mallophaga on them.

Fall.—Soon after the postnuptial molt begins, the males cease to sing, and this, as well as the inactivity of both adults and young during the molt, makes them extremely difficult to find. Few observers have ever seen a Kirtland's warbler later than July. Verne Dockham believes that after July they largely leave the jack-pine habitat; he has several times seen them in August, always near the ground, in the adjoining hardwood. The only known Michigan specimens taken later than September 1 are several in the Max M. Peet collection found in jack-pine near Luzerne September 5 to 9, 1916, and one male found September 28, 1919, in jack-pine seven miles south of Houghton Lake village. Kirtland's warbler has never been recorded in Michigan in the fall south of the jack-pine plains.

Winter.—Charles B. Cory (1879), who discovered the winter home of Kirtland's warbler when he collected a female on Andros Island in the Bahamas on January 9, 1879, reported that its actions resembled those of the myrtle warbler and that it seemed to prefer the thick brush. Its stomach contained insects. However, most of our knowledge of the winter habits of this species is derived from C. J. Maynard's account (1896) of his experience with it in the Bahamas in 1884:

> Kirtland's Warblers are shy birds of solitary habits, for never in any case did I find two together. They inhabit the low scrub, preferring that which is only three or four feet high, but retire at night to roost in the higher, more dense shrubbery near the spots which they frequent during the day. Those taken were, with one or two exceptions, found in an exceedingly limited area, within a mile or two of the city, and always in old fields grown up to low shrubbery. I have never heard Kirtland's Warbler sing, the only note that they uttered was a harsh chirp, with which they greeted me when alarmed at my approach. When one was not secured at first sight, it generally retreated into the bushes and silently disappeared. The thick and tangled character of the scrub rendered any quiet or swift pursuit impossible, thus a retreating bird was never seen again that day, and a number seen escaped in this way.
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> As with many shy birds, however, these warblers presented strange exceptions to the usual rule; twice at least as I was making my way through the thickets in

search of the Greater Yellow-throat, I was confronted by a Kirtland's Warbler. In both instances the birds appeared from out of the thicket within a yard of my path, remained a few seconds then darted off into the scrub.

The earliest autumn record for the Bahamas seems to be November 13 (1891, Eleuthera); and the latest spring record, April 25 (1887, New Providence).

Twomey (1936) has made the interesting point that the temperature and rainfall conditions in the Bahamas during the period December through April are very similar to those in the Kirtland's range in Michigan during the breeding season.

DISTRIBUTION

Breeding range.—Kirtland's warbler breeds in Michigan **north** to Montmorency County (Clear Lake), **east** to Alpena County (southwest of Alpena) and Iosco County (west of Oscoda), **south** to Ogemaw County (west of Rose City) and Clare County (northwest of Harrison), and **west** to Wexford County (north of Manton) and Kalkaska County (northeast of Kalkaska).

Winter range.—The winter range is restricted to the Bahamas. The species has been recorded from: Abaco, Little Abaco, Berry, Eleuthera, New Providence, Athol, Andros, Watling, Green Cay, and Caicos Islands.

Migration.—Early dates of spring arrival are: Florida—West Jupiter, April 27. Georgia—Cumberland Island, April 12. South Carolina—St. Helena Island, April 27. Missouri—St. Louis, May 8. Ohio—Avondale, May 4; Columbus, May 8; Cleveland, May 13. Illinois—Glen Ellyn, May 7. Indiana—Wabash, May 4. Ontario—Toronto, May 16. Minnesota—Minneapolis, May 13. Michigan—Ann Arbor, May 6; Oscoda County, May 8.

Fall dates are: Ontario—Point Pelee, October 2. Ohio—Holland, September 22; Columbus, September 11. Virginia—Fort Myer, September 25. South Carolina—Chester, October 11; Mount Pleasant, October 29; Charleston County, October 4.

Egg dates.—Michigan: 40 records, May 28 to June 30 (July 17 in the case of a second nesting after the destruction of the first set of eggs).

DENDROICA DISCOLOR DISCOLOR (Vieillot)

NORTHERN PRAIRIE WARBLER

PLATES 53, 54

HABITS

The common name of this bird is a decided misnomer, as it is not to be found on the real prairies of the Middle West. Perhaps it was given the name because it has been found on the so-called prairies or flat, grassy lands among scattered trees in the southern States in winter. Wilson and Audubon both used the name, but neither of them knew the bird very well, and their accounts of its nesting habits are decidedly erroneous.

The prairie warbler is one of the birds that has benefited by settlement of the country, for the clearing away of the forests has provided suitable habitats for it in brushy clearings and open sprout lands. Consequently, it has greatly extended its range and increased in abundance until now it is a very common bird in certain favored localities. Its range is quite extensive in the eastern United States, but its distribution is very spotted and its numbers seem to vary considerably from year to year. Dr. F. A. E. Starr wrote to me a long time ago that the prairie warbler had "of late years" extended its range into Ontario; he first met with it in 1916. It seems to have been very erratic in its appearance since then, for Dr. Paul Harrington, of Toronto, writes to me: "At Wasaga Beach (Simcoe County), bordering Georgian Bay, the prairie warbler was a common bird in 1914–15. In 1919 the birds were becoming rarer, and in 1924 only two males were observed and only one deserted nest found. In 1937 the birds were again fairly common, although in nothing like their former abundance. The birds have decreased yearly since then, and in 1941 only one singing male was heard. The birds occupied only a narrow strip covered with ground juniper, bordering the shore line. These birds have never been observed in other apparently suitable habitats further inland."

I have noted a decided increase in the numbers of prairie warblers in southeastern Massachusetts during the past 40 years. In the region where I formerly hunted, we were lucky if we could find one or two nests in a season; but in 1944 we could find as many as a dozen in a day, if we searched thoroughly. And, driving along the old country roads anywhere, if we happen to pass a brushy hillside, or an old clearing that has grown up to sprout land, we are almost sure to be greeted by the thin crescendo notes of this warbler, a most distinctive and easily recognized song.

Brewster (1906) gives this attractive sketch of the haunts of this warbler near Cambridge, Mass.:

> Many and delightful were the days I used to spend looking for nests of the Prairie Warbler in the hill pastures of Arlington and Belmont. These breezy uplands are attractive at any season, but most so in early June when the barberry bushes blossom. This is the time when our Prairie Warblers have full sets of fresh eggs. A search for their nests among the handsome, dome-shaped barberry bushes, covered with young foliage of the tenderest green, and with graceful, pendant clusters of golden yellow flowers that fill the air with fragrance and attract myriads of droning bees, is a fascinating and memorable experience, whatever be its material results.

Dr. Coues (1888) describes a well-populated locality near Washington, D. C., as follows: "The locality is along the Potomac River, on the Virginia side, about seven miles from the city, among some small hills from which all the large trees have been cut away, and which are now grown up to a thick scrub of hickory, dogwood, and laurel (*Kalmia latifolia*), with here and there a few young pines and cedars. Here we found breeding within a small area an astonishing number of the birds, perhaps more than fifty pairs."

On the pine barrens of Cape Cod, Mass., where the prevailing trees are pitch pines (*Pinus rigida*), more or less widely scattered, the prairie warbler finds a congenial summer home in the undergrowth of scrub oaks. Similar haunts are frequented on the pine barrens of New Jersey and farther west and south, where the shortleaf pine (*Pinus echinata*) is the characteristic tree. In such places the pine warblers live mainly in the pines and the prairie warblers in the underbrush, both birds being usually found wherever such conditions prevail, each in its own sphere.

Spring.—Dr. Chapman (1907) writes of the spring migration: "From its winter home in the West Indies and Florida, the Prairie Warbler begins to move northward early in March, though the full tide of migration does not start until the last of the month.

"The latest records of striking the southern lighthouses are in the first half of May and the earliest spring date is March 7. Thus the period of spring migration in the southern United States extends through more than nine weeks."

Territory.—We have sometimes found as many as a dozen pairs of prairie warblers nesting within a limited area, but we have never seen any such concentration as that mentioned by Coues. Forbush (1929), however, says: "Although it breeds occasionally in colonies, the nests are widely scattered, and each male seems to patrol a certain small territory to which he lays claim, and where he is always ready to give battle to any rival who encroaches on his section; but if danger in the shape of some enemy threatens the family of any one of them, the entire colony soon joins in protesting the invasion or threatening the invader."

Nesting.—In our egg-collecting days of long ago, we used to find plenty of nests of the chestnut-sided warbler in the fringe of low hazel bushes that lined the old country roads in Rehoboth, Mass. What few nests of the prairie warblers we found were in the more extensive sprout lands or on the brushy hillsides, well back from the roads. But in 1944 we were surprised to find that the prairie warblers had almost entirely replaced the chestnut-sided and were nesting in the hazel thickets along the road sides. The nests were artfully concealed in the densest parts of the foliage, about 2 or 3 feet about the ground, and could be seen only by parting the bushes. Other nests were found where woods had been cut off or burned over and a low growth of deciduous saplings had sprung up, mixed with tangles of blackberries and sweet fern. One nest was only 20 inches from the ground, well-hidden in a thick clump of sweet fern; others were in oak, poplar, wild apple, or cherry, or maple saplings, seldom over 3 or 4 feet above the ground, and often plainly visible. On the pine barrens of Cape Cod we find the nests in the leafy tops of the scrub oaks, and at similar heights among the pines.

Of the nests found by Dr. Coues (1888) near Washington, D. C., one was about 2½ feet up in a triple prong of a low laurel bush; another was 5 feet from the ground in a blackberry bramble, "made almost entirely of dandelion down, closely felted, and further secured with a few straws, and is stuccoed over outside with small dry leaves. The inside is copiously lined with red cowhair, making a marked color contrast with the other materials." A third was placed in a very young pine, about 1½ feet from the ground and against the main stem. Another was in an unusual situation, in a mass of grapevine twigs, about three feet from the ground.

Harold H. Bailey (1913) says that, in Virginia, "the earliness or lateness of the season has much to do with the location of their nests. Late springs, when the foliage is retarded and little shelter or protection is given the nest, it is invariably placed in a clump of holly scrub, or wax myrtle, whose foliage remains green throughout the entire winter. Sometimes I have found them in a small sapling cedar, placed near the trunk and ten feet from the ground, other times equally as high or higher, on a horizontal limb of a tree on the edge of a clearing."

T. E. McMullen has sent me the data for 14 nests found in New Jersey, 11 of which were in hollies in large woods. Richard C. Harlow tells me that on the coast of Virginia the prairie warbler nests commonly at heights of 10 or 15 feet in pines; he found one occupied nest 25 feet up and 10 feet out near the end of a horizontal pine limb. In North Carolina, according to Pearson and the Brimleys (1919), this warbler "seams to prefer sweet-gum saplings as nesting trees near Raleigh, nine out of seventeen nests examined by C. S. Brimley having been thus situated. Two were in elms, two in huckleberries, and one each was found in pine, sumac, black haw and *Ilex decidua*." All the Ontario nests referred to in notes from Dr. Starr and Dr. Harrington were in clumps of low junipers, 1 to 3 feet above the ground.

Edward R. Ford writes to me: "One of the few localities in the Chicago region in which it nests does not seem to be well selected. On the sunny, wind-swept shore dunes of Lake Michigan, in Porter

County, Ind., the sandcherry (*Prunus pumila*) forms a sparse cover on slope and crest. Two or three feet up in this slight vegetation, whose smooth stems afford only a precarious fastening for the nests, several have been found. The writer noted one which had slipped from its place and spilled the four eggs unbroken on the sand."

A typical nest before me, collected in Taunton, Mass., was well concealed, only 20 inches above the ground, in a cluster of branches and twigs in a dense clump of sweetfern, close beside a woodland path in a burnt-over woodlot growing up to sprout land. It is well and compactly made of very fine grayish plant fibers, a little very fine grass, some fine shreds of soft inner bark and a quantity of buff-colored down from cinnamon ferns, as well as some other soft, gray, downy substances, all firmly bound with spiders' silk. It is lined with soft, gray and white hairs and a few small white feathers. Externally it measures 3 by 2¾ inches in diameter, and about 3¼ in height; the inner diameter averages about 2 inches, and the cup is nearly 2 inches deep.

Eggs.—Three to five eggs, usually four, constitute the full set for the prairie warbler. The eggs vary in shape from ovate to short ovate, with occasionally a tendency toward elongate-ovate. They are only slightly lustrous. The ground color is usually white, sometimes creamy white or slightly greenish white. They are spotted or speckled with "chestnut," "auburn," or "russet," with underlying marks of "brownish drab." Some eggs are marked only with the brown shades; others have the drab undertones predominating. Some eggs are spotted with "Mars brown" and "mummy brown," with undermarkings of "deep mouse gray," but this type of marking is not as common as the reddish-brown shades. Usually a distinct wreath is formed at the large end where the spots are concentrated. The measurements of 50 eggs average 15.9 by 12.3 millimeters; the eggs showing the four extremes measure **17.6** by 13.2, 15.9 by **13.8, 14.7** by 11.7, and 16.3 by **11.2** millimeters (Harris).

Young.—The period of incubation is probably about 14 days, and the young remain in the nest about 10 days (Burns, 1915b and 1921). It would seem as if the incubation period might be somewhat shorter and the nest life a little longer, but accurate data appear to be lacking. The female probably does all the incubating and brooding, but both parents feed the young and take good care of them. The nest life does not seem to have been carefully studied.

Plumages.—Dr. Dwight (1900) describes the juvenal plumage, in which the sexes are alike, as "above, dull olive-green, browner on the pileum. Wings and tail clove-brown edged with dull olive-green; two wing bands buff. Below, dull brownish white, pale straw-color on the abdomen. Sides of head drab; eyelids white."

The postjuvenal molt, involving the contour feathers and the wing coverts, but not the rest of the wings or the tail, begins about the middle of July. He describes the young male in first winter plumage as "above, grayish olive-green, an area of concealed chestnut on the back. Wing coverts black, edged with olive-green; two wing bands white. Below, pale canary-yellow, streaked on the sides of the throat and breast with dull black veiled by yellowish edgings. Malar stripe and transocular streak grayish black; orbital ring, suborbital region and obscure superciliary stripe white, yellow tinged; auriculars mouse-gray." The female "is browner above and paler below with fainter streaking; the auriculars and transocular streak being grayer, the chestnut on the back a mere trace; the wings and tail are duller."

The first nuptial plumage is acquired by a partial prenuptial molt, "which involves chiefly the crown, sides of head, chin and throat but not the rest of the body plumage the wings nor the tail, as shown by specimens taken in Jamaica, W. I., November 27th, December 30th, January 3d, 13th, 19th, 24th and 31st. * * * The black auriculars and transocular stripe and the yellow feathers of the superciliary stripe, the chin and throat are assumed, wear bringing the chestnut of the back into prominence. Young and old become practically indistinguishable." The female is similar, but the yellow is paler, the streaking less extensive and the chestnut fainter.

Adults have a complete postnuptial molt in July and a partial prenuptial molt, as in the young birds. Winter adults are like the first winter birds, but the colors are richer and deeper.

Food.—No very comprehensive study of the food of the prairie warbler seems to have been made. However, the stomachs of 15 prairie warblers collected in Puerto Rico by Dr. Wetmore (1916) were found to contain 100 percent animal matter in percentages as follows: Hemiptera, 43.78; Coleoptera, 16.00; Hymenoptera, 3.82; Diptera, 0.35; spiders, 19.59; and miscellaneous, 3.76. Mr. Forbush (1929) says that it takes quantities of plant-lice and some grasshoppers and locusts.

Behavior.—The prairie warbler is a lively little bird, very active in pursuit of its insect prey, and quite demonstrative in the defense of its nest, flitting about in the vicinity of the intruder and sometimes becoming quite bold or inquisitive. It is not particularly shy. Francis H. Allen (MS.) says that it "has a habit of twitching its tail nervously from side to side, as it hops and flits among the bushes. I have seen it catching flies on the wing and, also, taking insects from the tops of low bushes by hovering before them with blurred wings like a hummingbird." The tail-wagging of the prairie warbler is not so pronounced or so persistent as with the palm warbler, with longer intervals between these motions. Although it is essentially a bird of the underbrush and low growths, where it obtains most of its food, it often selects a singing perch near the top of a fair-sized tree.

Voice.—Aretas A. Saunders has sent me the following careful study of the song of this warbler: "The song of the prairie warbler is the most distinctive one I know in the genus *Dendroica.* It consists of a series of notes rising gradually higher in pitch to the end of the song. They are separated and distinct from each other and not run together in a trill or linked in 2-note phrases. The quality is sibillant, but pleasingly musical and of medium loudness.

"Songs vary considerably in details. The change in pitch between the lowest and the highest notes of the song varies all the way from one to five and a half tones, averaging two and a half tones. While the first note of the song is the lowest in pitch, it is not always true that each succeeding note is a little higher, but often the first few notes are all on the lowest pitch. There may be anywhere from 1 to 6 notes on this lowest pitch before the rise in pitch begins. My 35 records show that 2, 3, or 4 notes on the low pitch are more frequent than only 1. The number of notes per song varies from 5 to 13, averaging 9. When 5 or 6 notes, at the beginning, are all on the same pitch, more than half of the song is over before a rise in pitch begins. In all but 4 of my records the last note stands alone as the very highest, but in 2 records there are 2 highest notes at the end, and in 1 there are 4. Only a single record has the next to the last note the highest, and in that record the last note drops to a pitch lower than the note at the beginning.

"The pitch varies from A''' to G sharp'''', half a tone less than an octave. The upward grading of pitch is usually in half-tone steps, but is sometimes less regular, and in 10 of my records are quarter tones, that could not be played on a piano or any graded instrument.

"In a majority of records the notes are all of equal length, but in 9 records the first 3 to 6 notes are longer and slow, and the last notes shorter and about twice as fast. Songs vary greatly in the rapidity of the notes. The length of songs varies from 1⅖ to 2⅗ seconds. The longest song, in time, contains only 9 notes, whereas the largest number of notes, 13, took 2⅕ seconds.

"The period of song lasts from the arrival of the bird in migration to the middle of July. In only four seasons have I had opportunity to hear this song in July. These show an average date of July 17 for the last song, extreme dates being July 14 and July 24. Rarely the bird revives its song in early September. In most years it is apparently entirely silent at this season."

Francis H. Allen writes to me: "I found one singing in the same pasture with a field sparrow and singing a song that puzzled me until I got a view of the singer. Comparing the songs of the two birds, I found that the opening four notes, all on the same pitch, were almost precisely alike except that the warbler's were simple, *tee*, *tee*, *tee*, *tee*, while the sparrow's were slightly dissyllabic, *t'wee*, *t'wee*, *t'wee*, *t'wee*. The pitch, tone, and quality were the same. The rest of the warbler's song went up the chromatic scale characteristically, while the sparrow's ended with a descending trill. The two birds kept near together and sang antiphonally, or apparently so. This seemed like a clear case of imitation on the part of the prairie warbler." More likely this was one of the variations in the warbler's songs, as described by Mr. Saunders, rather than an imitation.

Field marks.—The prairie warbler should be easily recognized, as it is distinctively marked, with its bright-yellow under parts, more or less streaked with black on the sides, two yellowish wing bands, and largely white outer tail feathers. The chestnut marks on the back are not always very conspicuous. Females and winter birds are not much different, merely duller in colors. The song is easily recognized.

Enemies.—The northern prairie warbler is a common victim of the cowbird. Dr. Friedmann (1929) had 10 records from its limited range, in the eastern States. Harold H. Bailey (1925) says that the nest is often abandoned after the cowbird's egg is laid in it, but that "often this warbler has been known to construct a false bottom over the Cow-bird egg, and any of her own that were in the nest, as well, and start laying again." Harold S. Peters (1936) lists as external parasites of the northern prairie warbler a louse, *Ricinus pallens* (Kellogg), and a tick, *Haemaphysalis leporis-palustris* Packard.

Fall.—In Massachusetts, the southward migration begins early. As soon as the young are fully grown the family parties wander about in the brushy pastures during July, and after molting some of them start south before the end of that month. The migration is well under way during August, very few remaining in September. In the more southern States, the migration continues from the middle of August until the first week in November. It has been recorded in northern Florida as early as July 27, and has struck the light on Sombrero Key as early as August 1 and as late as November 4, indicating a much-prolonged migration season.

Winter.—A few northern prairie warblers may winter in the southern half of Florida, but probably most of the wintering birds in Florida are of the southern race. The main winter home of the northern birds is in the Bahamas and the West Indies. C. J. Maynard (1896) writes: "The Prairie Warblers were very abundant in the dense thickets on the island of Key West during the autumn and early winter of 1870. They frequented the drier portions of the Key but did not sing." Those that he reported in the mangroves along the coast of the mainland were probably Florida prairie warblers, which are known to frequent such localities. The following remark perhaps refers to both forms: "The Prairie Warbler is by far the most abundant of all the genus on the Bahamas, even as far south as Inaugua, throughout the winter, remaining as late as the last week in April. They are found everywhere, in pine woods, scrublands, fields, and even among the mangroves of the little outlying keys. I found them also abundant about Kingston, Jamaica, and a few on Cayman Brac from March 23d to the 28, 1888, but these were evidently migrating and do not remain long." Dr. Wetmore (1916) says:

> In Porto Rico these birds occur at the highest altitudes (above Aibonito, at 2,000 feet), and are found in brushy growths, in pastures where there are thickets, and along the hedges of emajagua (*Paritium tiliaceum*). Dry, brushy growths back of the beaches also are favorite places, and many live in the dry forests of Vieques. In spring there was a marked diurnal movement toward the west, and on Vieques there were distinct waves of migration on March 19 and March 27. Another was noted on Culebra Island on April 9. In each case the birds were in company with many other warblers. * * * The prairie warbler is apparently much more common as a migrant than as a true winter visitant.

DISTRIBUTION

Range.—Eastern United States and the West Indies.

Breeding range.—The prairie warbler breeds **north** to northeastern Kansas (Lake Quivira); central Missouri (Columbia); southeastern Iowa (Lee County); northeastern Illinois (Peoria and Chicago); central Michigan (Berrien County and Lovells); southern Ontario (Honey Harbor, Wasaga Beach, and St. Williams); central New York (Schenectady); southern New Hampshire (Concord and Manchester); and northern Massachusetts (Haverhill). **East** to the Atlantic coast from northeastern Massachusetts (Haverhill) to southern Florida (Miami and Key West). **South** to southern and western Florida (Key West, Fort Myers, and Cedar Keys); central Georgia (Macon and Columbus); south central Alabama (Autaugaville and Greensboro; and northern Louisiana (Monroe). **West** to central northern Louisiana (Monroe); central and western Arkansas (Hot Springs, London, and Winslow); northeastern Oklahoma (Tulsa and Ponca); and northeastern Kansas (Lake Quivira). Occurrences of the prairie warbler in summer have been recorded north to central Iowa (Polk County and West Liberty); southeastern Wisconsin (Madison and Appleton); northern Michigan (Hillman); central Ontario (Frank's Bay and Lake Nipissing); north-central New York (Holland Patent); and southern Maine (Sanford and Little Green Island). The first known occurrence in Ontario was in 1900, and it now breeds to the shore of Georgian Bay.

Winter range.—The prairie warbler is found in winter **north** to southern South Carolina rarely (Beaufort and Charleston, occasionally Bulls Island); the Bahamas (Nassau, Watling, and Caicos); the Dominican Republic (Samaná); the Virgin Islands (St. Thomas); and the Lesser Antilles (Anguilla Island). **East** to the northern Lesser Antilles (Anguilla, Barbuda, and Antigua.) **South** to Antigua Island; Puerto Rico; Hispaniola (Gonave Island); Jamaica; the Swan Islands; Banco Chinchorro, Quintana Roo; occasionally south to Corn Island, Nicaragua. **West** to the islands off Quintana Roo (Banco Chinchorro and Cozumel); western Cuba (Isle of Pines and Habana); western Florida (Key West, Sanibel Island, Tarpon Springs, and Gainesville); and southern South Carolina (Beaufort).

The range as outlined includes two subspecies or geographic races. The northern prairie warbler (*D. d. discolor*) inhabits all the breeding range except the mangrove swamps of southern Florida from New Smyrna and Anclote Key southward where it is replaced by the Florida prairie warbler (*D. d. collinsi*).

Migration.—Last dates of spring departure from the winter home are: Virgin Islands—St. Croix, April 3. Puerto Rico—Mayagüez, April 23. Haiti—Grande Cayemite Island, April 13. Cuba—Habana, May 8. Bahamas—May 13 (struck light). Mississippi—Edwards, May 30.

Early dates of spring arrival are: Florida—De Land, March 13. Alabama—Prattville, March 30. Georgia—Savannah, March 8. North Carolina—Chapel Hill, April 1. Virginia—Lawrenceville, April 5. West Virginia—Bluefield, April 22. District of Columbia—Washington, April 12. Pennsylvania—Philadelphia, April 23. New York—New York City, April 25. Massachusetts—Danvers, May 1. Louisiana—Monroe, March 30. Mississippi—Gulfport, April 6. Arkansas—Delight, April 7. Tennessee—Chattanooga, April 5. Kentucky—Bowling Green, April 6. Missouri—St. Louis, April 11. Indiana—Wheatland, April 15. Ohio—Fremont, April 11. Michigan—Ann Arbor, May 2. Ontario—Toronto, April 17. Wisconsin—Madison, April 23. Oklahoma—Norman, April 22. Kansas—Lake Quivira, April 28.

Late dates of fall departure are: Wisconsin—Milwaukee, October 8. Missouri—St. Louis, September 23. Michigan—Detroit, September 30. Ontario—Point Pelee, September 5. Ohio—South Webster, October 8. Indiana—Waterloo, September 26. Illinois—Chicago, October 4. Kentucky—Bowling Green, October 15. Tennessee—Tate Spring, September 25. Louisiana—Monroe, September 21. Mississippi—Deer Island, October 29. New Hampshire—Jaffrey, September 1. Massachusetts—Martha's Vineyard, October 6. New York—Far Rockaway, September 28. Pennsylvania—Philadelphia, October 18 (struck city hall tower). District of Columbia—Washington, October 3. Virginia—Salem, October 9. West Virginia—Bluefield, October 13. North Carolina—Raleigh, October 10. Georgia—Fitzgerald, October 22. Alabama—Anniston, October 15. Florida—Sombrero Key, November 6 (struck light).

Early dates of fall arrival are: Mississippi—Bay St. Louis, July 22. Florida—Pensacola, July 20. Bahamas—Maraguana, August 8. Cuba—Cienfuegos, August 16. Puerto Rico—Coamo Springs, September 7. Virgin Islands—St. Croix, September 10.

Casual records.—There is a single record of the occurrence of the prairie warbler in Bermuda, a specimen collected on October 3, 1848. On October 23, 1924, a prairie warbler came aboard a ship about 300 miles north of Puerto Rico and after about five minutes aboard it flew off toward Puerto Rico.

Lighthouses.—The prairie warbler is frequently reported to strike lighthouses in Florida, usually in small numbers. At Sombrero Key they have struck during the periods from March 7 to May 12, and from August 1 to November 4, with 47 the largest number for a single night during the fall migration, but on the night of April 3, 1889, 150 struck the light of which 25 were killed. The keeper reported that the birds struck between midnight and 4 a. m. and that at the time a light rain was falling. At Alligator Reef they have been reported only in fall from August 22 to September 29. On the night of September 29, 1889, during a rainstorm, 190 struck of which 19 were killed. Many struck at Sand Key on August 13, 1902, and a few at Dry Tortugas Island on April 14, 1909.

Egg dates.—Florida: 10 records, April 23 to June 25; 5 records, May 12 to June 2.

Massachusetts: 56 records, May 29 to June 21; 36 records, June 4 to 11, indicating the height of the season.

New Jersey: 51 records, May 17 to June 13; 35 records, May 24 to June 6 (Harris).

DENDROICA DISCOLOR COLLINSI (Bailey)

FLORIDA PRAIRIE WARBLER

PLATES 55

HABITS

When Harold H. Bailey (1926) described this southern race, he called it Collins's warbler, after an old Florida collector. The A. O. U. Check-List adopted Bailey's scientific name but discarded his common name. He describes the type as having "a much lighter yellow breast, and throat almost white at base of lower mandible; with less reddish on back; which is decidedly grayish. The males lack the heavy wide black markings on sides, the heavy orange on throats; and the heavy reddish backs; all so pronounced on the northern breeding birds."

He adds: "Our Prairie Warbler of Dade and Monroe Counties, Fla., seems rather out of place as a breeding bird in our hardwood hammocks and amongst the mangrove Keys."

The 1931 A. O. U. Check-List states that it breeds "in mangrove swamps on the coast of Florida from New Smyrna and Anclote Key southward." Arthur H. Howell (1932) says of it:

> The Florida Prairie Warbler lives in a habitat very different from that chosen by its northern relative (*discolor*), being almost wholly restricted to tracts of mangroves bordering the coastal sloughs or marshes. At New Smyrna, R. J. Longstreet found several nests in small mangrove bushes growing on the borders of a marsh. One observed May 3, 1925, partly finished, contained one egg on May 16, but later was deserted. The nest was composed of grayish colored plant fibers, shreds of bark, and pieces of twine, and was lined with very fine shreds of palmetto fiber of a brownish color, and a few feathers. E. J. Court collected a set of 3 eggs on Palm Key, near Cape Sable, March 29, 1925. Nevin J. Nicholson reports a nest in process of construction in the top of a 20-foot mangrove tree at Fort Lauderdale, June 6, 1925. D. J. Nicholson noted a nest at Eifers, June 16, 1929, 11 feet up in a mangrove, and a newly made nest at the same place, May 10, 1931.
>
> On Anclote Key, May 21, 1918, we heard a dozen or more of these Warblers singing, and collected several specimens in breeding condition. The birds are rather shy during the nesting season; the males sing from near tops of small mangrove trees and manage to keep well hidden in the foliage. The song sounds to my ears essentially like that of the northern birds—a series of drawled, shrilling notes on an ascending chromatic scale, uttered rather rapidly, with the bill pointing nearly straight upward. * * *
>
> Examination of the stomachs of 10 specimens taken in Florida showed the food of this species to consist largely of moths and their larvae, beetles, bugs, flies, and spiders. Grasshoppers, tree-hoppers, ants and other Hymenoptera, and scale insects were eaten in smaller quantities, and one bird had picked up a fragment of a small bivalve.

Charles E. Doe has sent me the data for three sets of eggs of the Florida prairie warbler, collected by him on the west coast of Florida; the nests were all in red mangroves, all over water, and from 6 to 10 feet above it.

The measurements of 16 eggs average 16.3 by 12.0 millimeters; the eggs showing the four extremes measure **16.8** by 12.1, 16.2 by **12.7**, **15.9** by 11.8, and 16.0 by **11.1** millimeters (Harris).

DENDROICA PALMARUM PALMARUM (Gmelin)

WESTERN PALM WARBLER

PLATE 56

HABITS

Charles Lucien Bonaparte (1832) remarks: "This is one of those lively, transient visitants, which, coming in spring from warmer regions, pass through the middle states, on their way to still colder and more northern countries, to breed. From the scarcity of the species, its passage has hitherto been unobserved; and it is now, for the first time, introduced as a bird of the United States. Authors who have heretofore made mention of it, represent it as a permanent resident of St. Domingo, and other islands of the West Indies, and even describe its nest and habits, as observed there."

Bonaparte evidently did not notice the difference between the western and the yellow palm warblers, perhaps assuming that the latter was the spring plumage and the former the winter bird. It remained for Ridgway (1876) to point out the differences and separate the two subspecies. This is not strange, for the western bird is known to us mainly as a migrant and winter resident, its summer home being in central Canada, with a southward extension into northern Minnesota and Wisconsin. The 1931 A. O. U. Check-List does not include Wisconsin in its breeding range, but Francis Zirrer writes to me that it "is not overly rare during the summer" near Hayward, Wis. "Here the bird is a dweller in the cedar-tamarack-spruce bogs, and from its arrival in spring (early May) until its departure in fall (early October) it is rarely seen anywhere else. Probably because of this, because of the scarcity of interested observers, and because of the fact that high water in spring and early summer makes our bogs not easily accessible, the bird has more or less escaped the attention of Wisconsin ornithologists. After its arrival I see it feeding mostly in cedars and black spruces; later, when the tamaracks sprout new green, most of its searching for food is done there. Toward the end of August, when the breeding season is over and until its departure, it visits other trees, especially poplars, but even then only those close to the bog."

A. L. Rand (1944) records it as "a common summer resident, breeding, in northeastern British Columbia, 150 to 160 miles northwest of Fort Nelson along the Alaska Highway." He also mentions a specimen in the National Museum at Ottawa, "taken at Bernard Harbor, Dolphin and Union Straits, Sept. 28, 1915 by Fritz Johansen."

Spring.—The migration routes of the two races of the palm warbler are interesting. The yellow palm spends the winter in the Gulf States and crosses the more southern Alleghenies to migrate northward along the Atlantic coast to northern New England and southern Canada, while the western palm, leaving its winter home in Florida and the West Indies, crosses the Alleghenies in the opposite direction seldom as far north as the Carolinas, and migrates northward through the broad Mississippi Valley to Canada. Casual wanderers have, of course, occurred outside of these limits, but the main routes are as outlined. In Illinois, according to Ridgway (1889), "during the spring migration this is one of the most abundant of the Warblers, and for a brief season may be seen along the fences, or the borders of fields, usually near or on the ground, walking in a graceful, gliding manner, like an *Anthus* or *Seiurus*, the body tilting and the tail oscillating at each step. For this reason it is sometimes, and not inappropriately called Wag-tail Warbler."

Nesting.—The main breeding grounds of the western palm warbler are in central Canada, where only a few nests have been found. Probably the first recorded nest is the one mentioned by Ridgway (1889) in this brief statement: "Mr. Kennicott found a nest at Fort Resolution, in Arctic America. It was on the ground, on a hummock, at the foot of a small spruce tree in a swamp. When discovered (June 18), it contained five young."

In more recent years nests have been found in Alberta. A. D. Henderson writes to me: "The western palm warbler is a scarce breeder in the muskegs in the vicinity of Belvedere. Richard C. Harlow took a nest and five eggs in the moss of a muskeg on June 12, 1923. I was with Dick Harlow and Dick Rauch on June 11, 1924, in a muskeg when Rauch flushed a western palm warbler from a nest and five eggs. On June 16, 1924, Harlow took a nest and five eggs near the place he took the nest in 1923." Harlow tells me that his nest of June 11, 1924, was taken 12 miles west of Belvedere in a dry muskeg among scattered spruces and tamaracks. It was very well concealed at the base of a spruce seedling under a clump of dry grass growing near the top of a large hummock of sphagnum moss. The female flushed at about 2 feet, and the five eggs were three-quarters incubated. The nest was constructed of plant fibres, fine dry grass, and fine bark shreds, and was lined with feathers of the gray ruffed grouse.

Dr. L. H. Walkinshaw (MS.) reports a nest found at Fawcett, Alberta, "built a short distance from a bordering brushy area, in the sphagnum moss of the muskeg country, sunken into the moss at the base of a small dwarf birch." And a set of five eggs in the Doe Museum in Florida, was taken by T. E. Randall at Grassland, Alberta, on May 23, 1933, from a nest "a few inches from the ground in a tiny spruce."

Dr. T. S. Roberts (1936) mentions six cases of actual, or probable, nesting of the western palm warbler in northern Minnesota, and shows a photograph of a nest in Aitkin County. And Zirrer's notes show conclusively that the species breeds in northern Wisconsin.

Eggs.—The palm warbler lays 4 or 5 eggs; apparently 5 eggs are fully as common as 4. The eggs are ovate, sometimes tending toward short-ovate or elongate-ovate. They are only slightly glossy. The ground color is white or creamy white, and they are spotted, speckled or blotched with "chestnut," "bay," "auburn," or "Brussels brown," with undertones of "brownish drab" or "light Quaker drab." They vary from eggs delicately sprinkled to those marked with large blotches and/or a few scrawls of black. Generally the spots are concentrated and form a wreath around the large end. The eggs of one set in the Museum of Comparative Zoology are creamy white, very delicately speckled with "wood brown," and one egg is almost immaculate. The measurements of 15 eggs average 16.7 by 13.1 millimeters; the eggs showing the four extremes measure **17.5** by 13.2, 16.5 by **13.7**, and **16.0** by **12.7** millimeters (Harris).

Young.—Nothing seems to have been reported on incubation, brooding or care of the young nestlings of the western palm warbler, but Zirrer writes to me: "Once out of the nest, the young birds sit scattered on convenient branches, practically always a tamarack, and as a rule not more than 4 to 8 feet above the ground, waiting for the old birds to bring food. Before long, however, they begin to move with a creeping or sliding motion along the branches, usually from near the end of the branch toward the trunk; they fly, at first clumsily, from there to the nearest convenient branch or twig and creep or slide again, all the while picking at something. Ours here must have been infested with vermin, probably Mallophaga, as they would stop every once in a while and pick vigorously at the feathers and especially under the wings. Although they are soon able to find their own food, the old birds still feed them occasionally until the end of August.

Plumages.—The plumages and molts of the western palm warbler are apparently the same as those of the yellow palm warbler, to which the reader is referred. The western bird always has less yellow than the eastern.

Food.—Zirrer (MS.) writes: "Although I have watched these birds every summer since the spring of 1940, I am still unable to tell much about their food. I see them occasionally find and eat small green caterpillars, but most of the time I see them picking something from the twigs of the tamaracks without being able to tell what it is, although I have examined a number of twigs. I see them also hang on and examine cones on tamaracks two and more years old, even those on dead, dry trees, but what they find there I am unable to say. They like various berries, especially raspberries, however."

A. H. Howell (1932), referring to Florida, says: "R. W. Williams at Tallahassee, in October, 1904, observed large numbers of Palm Warblers feeding on cotton worms. F. M. Uhler, in studying the bird's food habits in the celery fields around Sanford, found the destructive celery leaf-tyer in nearly all the 23 stomachs examined, amounting to 73 percent of the total contents. Other items found in the stomachs were flies, 12.7 per cent; Lepidoptera (mainly cutworms), 6 per cent; and Hymenoptera, 7 per cent."

Robert H. Coleman (Judd, 1902) wrote to the Biological Survey that he counted the number of insects that one of these birds caught and found that it varied from 46 to 60 per minute. He writes: "He spent at least four hours on our piazza, and in that time must have gathered in about 9,500 insects." This warbler spends much time feeding on the ground, where it probably picks up some spiders and seeds.

Behavior.—The most characteristic trait of the palm warbler is its habit of almost constantly wagging its tail up and down, like a pipit, even while flitting about in the low trees. Strangely enough, Kirtland's warbler, the only other species of the genus *Dendroica* that habitually nests on ground, has the same habit. The palm warbler spends much of its time on the ground, where it has been said to walk with a gliding motion, but to me it seems to hop or run, though its little feet move so rapidly that it is not easy to see just which it does. W. B. Barrows (1912) writes of its behavior in Michigan:

> Although entirely unlike the Yellow-rumped Warbler in appearance, the two species have many points in common, and the present bird is equally fond of the ground, where it alights constantly for food, hopping about in search of seeds and insects, very much like a sparrow. It is usually found in flocks sometimes as many as fifty together, though more often in small squads of six to ten. It frequents the edges of fields, the borders of woods and the sides of hedges and roads, but is often seen frequently in open fields, particularly in the wetter parts of cattle pastures, where it perches on weed-stalks or on the ground, and when alarmed flies to the nearest fence, where it sits, wagging its tail up and down in a manner entirely unlike that of any other warbler.

Zirrer says in his notes: "For weeks after the young are able to fly, the family still roosts every night in the evergreens near where the nest was situated. They quit feeding and retire comparatively early, nearly an hour or so before dark. Any attempt to follow them there causes them to become highly nervous, to fly around and above a person's head and to chirp excitedly and loudly, until one leaves them alone and moves away."

Voice.—Several writers have likened the song of the palm warbler to that of the chipping sparrow or junco. Prof. Lynds Jones (1900) recognizes the resemblance, but remarks: "The trill remains as a prominent feature, but the note is no longer a true chip. Better *tsee tsee tsee tsee*, with a distinct swell. Each syllable should be given a half double utterance except at the middle of the swell, where the greater effort seems to completely coalesce the half double quality into one distinct syllable. There is a little similarity to the song of Myrtle Warbler, but lacking the liquid quality of that species." Dr. Leonard W. Wing (1933) gives a good description of the songs of this warbler:

> On its breeding grounds, the palm warbler was heard to have two distinct songs and an ordinary warbler *chip*. The first song, which appears to be song of the mated or nesting bird, is delivered from a favorite perch, generally the tallest pine in the bird's territory. It is given with the body erect, the head thrown back and the tail pointing straight down. I have written the song as

hee''-u hee''-u hee'-u hee'-u. The first notes are delivered slowly; the last two a little more rapidly; they are higher pitched and accented as indicated. The whole song, however, is delivered in a slow, unhurried manner. The tone is rich, soft, and liquid. It has a cool, distant quality.

The second song, which may be the courting song, is almost indistinguishable from the songs of the Pine Warbler or the Eastern Chipping Sparrow. Indeed, it bears a striking resemblance to the song of the Slate-colored Junco and Myrtle Warbler. However, the Pine Warbler sings only from the taller, older trees; the Western Palm Warbler prefers the fresh growth. The song is a trill, sweeter and more musical than the song of the Eastern Chipping Sparrow and stronger than the song of the Pine Warbler. It is generally given while the bird is moving (sometimes very rapidly) through the jack pine. The singing bird stays in the same territory, though he circles a great deal. Occasionally a feeding bird bursts out with this song. It is heard oftener than the song first described. I have written it *weet weet weet weet,* with no inflection.

Field marks.—The western palm warbler looks like a washed-out yellow palm warbler. The reddish-brown crown is duller, and there is little yellow anywhere except the paler yellow on throat and under tail coverts and the greenish-yellow rump; the brownish-gray wing bars are not conspicuous. In fall and winter birds the colors are still duller, but the rump and under tail coverts are still yellowish, and there is a whitish line over the eye. The bobbing tail is always diagnostic.

Enemies.—This northern breeding race is apparently rarely imposed upon by the cowbird. Dr. Friedmann (1934) says that "Mr. T. E. Randall found two parasitized sets in Alberta."

Fall.—Zirrer (MS.) writes of the association of these warblers with chickadees in late summer and fall: "Soon after their own breeding season is over, toward the beginning or middle of July, the chickadees make steady companions of various species of warblers with similar feeding habits, here the myrtle and, especially, the palm warbler. I do not remember a day, from the time the young palm warblers are out of the nest until their departure in fall, without seeing the chickadees as their steady companions.

"Later, when the palm and myrtle begin to stray with other warblers (and also other birds) of similar feeding habits throughout the neighborhood, the call of a chickadee means that a flock of warblers is close at hand. All one has to do is to wait a few moments, watch and listen; and there they come, palms, myrtles, magnolias, several vireos, a tree creeper, an occasional nuthatch, and, of course, a flock of chickadees. This goes on until the middle of October, when the last of the warblers, the myrtle, has gone south. This may be observed not only in our bogs and their immediate neighborhood, but throughout all of our woodlands."

N. A. Wood (1911) tells of a heavy migration of western palm warblers across Saginaw Bay, Mich. The first one was seen on August 24, and the numbers increased in successive migration waves of small birds, until the third wave "occurred on the night of September 18, and on the morning of the 19th the species was very abundant. There must have been thousands of individuals about the light-house, where they fed partly on flies that collected on the window screens and sides of the house, and apparently also on ground insects and possibly seeds of the beach grasses." These birds all passed on, and another big wave came on October 5. "Among the birds in this movement there were thousands of this species and of the myrtle, and large numbers of black-throated blue, and black-throated green warblers, American redstarts, juncos, vesper sparrows and a few horned larks."

The western palm warbler is an abundant fall migrant through the broad Mississippi Valley to the Gulf States where it turns abruptly eastward into Florida, crossing the fall route of the yellow palm warbler. Although the main route is southward, chiefly west of the Alleghenies, its trend is more eastward than the spring route. In Massachusetts it occurs fairly regularly, though rarely, in fall; and it is commoner in western Pennsylvania and in South Carolina in fall than it is in spring, though it spends some winters in small numbers in the latter State. During the fall migration it frequents old brush-grown fences, hedge rows, brushy fields, and open pastures, spending most of its time in low trees or bushes or on the ground, often in company with the flocks of migrating sparrows, juncos, and other ground feeders.

Winter.—Although the western palm warbler's winter home is mainly in Florida, Cuba, and the West Indies, it is a hardy bird and has been found in winter far north of its main winter range. Forbush (1929) gives a number of December and January records for Massachusetts, and a January record for Grand Manan, New Brunswick. As a winter visitant in South Carolina, it seems to be irregular; Wayne (1910), strangely enough, says that "it appears more frequently during severe winters than in milder ones." Dr Eugene E. Murphey (1937) calls it abundant in the middle Savannah Valley, in southern Georgia, arriving in October and departing early in April, "and is to be found in low grassy damp meadows and particularly in the cotton fields after the cotton has been picked and the leaves have fallen."

The western palm warbler is one of the characteristic small birds in all parts of Florida in winter. In the regions where I have spent the winter it is a common dooryard bird, hopping or running about on the lawns or flitting through the shrubbery and low trees, even in the city yards and gardens. It is about the only small bird to be seen so close to houses. It seems to obtain most of its food on the ground, but it also inspects the tiny yellow blossoms in the center of the circle of bright red leaves of the poinsettias, where it may find some food. It is an inconspicuous little bird while foraging among the dry, brown leaves, but the frequent wagging of its tail betrays it.

Mr. Howell (1932) writes: "The Palm Warbler is a prominent feature of winter bird life in Florida, and in many places it is the most abundant species, often occurring in loose flocks numbering 50 or more. The birds are found in a variety of situations—hammocks, prairies, marshes, pine flats, old fields, cultivated lands, town yards, and even the Gulf beaches."

Dr. Barbour (1923) calls this warbler the commonest bird in Cuba during the winter months. "Its bobbing tail may be seen by every dusty roadside, along fences, in pastures, gardens and in the very cities themselves—if there be a park with any cover. They come in September and retire late in April, the males having begun to assume the nuptial dress just as they leave. The birds seem to be such an essential part of the Cuban winter landscape that it is hard to believe that they are not natives."

The palm warbler is equally common, really abundant, in nearly all the Bahama Islands in winter, according to several observers. It frequents the vicinity of the seashore, the scrub fields and pastures, the neighborhood of houses and gardens, and even the streets of the cities and towns.

DISTRIBUTION

Range.—Canada to the West Indies.

Breeding range.—The palm warbler is known to breed at least **north** to southern Mackenzie (Simpson, Providence, and Resolution); northern Saskatchewan (north shore of Athabaska Lake near McFarlane River); northern Manitoba (Churchill); central Quebec (Fort George, Mistassine Post, and Piashti); and central Newfoundland (Grand Lake, Bever Lake, and Gander). **East** to Newfoundland (Gander) and Nova Scotia (Baddeck, Halifax, and Barrington). **South** to southern Nova Scotia (Barrington); southern Maine (Mount Desert Island and Auburn); southern Quebec (Montreal); southern Ontario (Ottawa, rarely, and Sault Ste. Marie); northern Michigan (Lovells); possibly northern Wisconsin (Ladysmith); northern Minnesota (Aitkin, Cass Lake, Itaska Park and Thief Lake); southern Manitoba (Indian Bay and Lake St. Martin); central Saskatchewan (Cumberland House, probably, Emma Lake, and Flotten Lake); central Alberta (Flat Lake, Boyle, and Glenevis); and northeastern

British Columbia (Trutch and Miniker River). **West** to northeastern British Columbia (Miniker River and Fort Nelson) and southwestern Mackenzie (Simpson). Judging from the data on migration of the palm warbler the northern limit of the breeding range is in the unexplored regions to the north, possibly the limit of trees.

The palm warblers which occupy the range as outlined are divided into two geographic races: the western palm warbler (*D. p. palmarum*) breeds **east** to central Ontario, while the eastern part of the range is occupied by the yellow palm warbler *D. p. hypochrysea*).

Winter range.—The palm warbler winters regularly **north** to central Louisiana (Alexandria); central Alabama (Prattville); northern Georgia (Atlanta and Athens); and northern South Carolina (Chester). It is casual in winter north to Bicknell, Ind.; Columbus, Ohio; Toronto, Ontario; Doylestown, Pa.; Garden City and Shelter Island, N. Y.; and Martha's Vineyard, Mass. **East** to South Carolina (Chester and Charleston); eastern Georgia (Savannah and Brunswick); eastern Florida (Fernandina, St. Augustine, New Smyrna, and Miami); the Bahama Islands (Nassau, Watling, and Caicos); Hispaniola (Sánchez); Puerto Rico (San Juan); and the Virgin Islands (St. Croix). **South** to the Virgin Islands (St. Croix); Jamaica; and Providence Island. **West** to Providence Island; northern Honduras (Roatán Island); Quintana Roo (Bauco Chinchorro); Yucatán (La Vega and Progresso); and Louisiana (Chenier au Tigre and Alexandria).

The two races of the palm warbler tend to cross each other's routes in migration. The eastern form is more abundant in the western part of the winter home, while the western form is commoner in southern Florida and the West Indies.

Late dates of departure from the winter home are: Puerto Rico—San Juan, April 8. Dominican Republic—Samaná San Thomé, May 12. Cuba—Cienfuegos, May 6. Bahamas—Andros, May 2. Florida—Daytona Beach, May 10. Alabama—Birmingham, May 8. Georgia—Darien, May 18. Louisiana—Ruston, April 22. Mississippi—Rosedale, April 30.

Early dates of spring arrival are: Virginia—Charlottesville, March 27. West Virginia—Bluefield, April 3. District of Columbia—Washington, March 26. Pennsylvania—Harrisburg, March 16. New York—New York, April 2. Massachusetts—Harvard, March 30. Vermont—Rutland, April 6. Maine—Dover-Foxcroft, April 2. Quebec—Kamouraska, April 25. Nova Scotia—Bridgeton, April 14. New Brunswick—Saint John, April 13. Prince Edward Island—Tignish, May 2. Newfoundland—Tompkins, May 11. Tennessee—Nashville, March 20. Illinois—Chicago, April 8. Indiana—Goshen, April 17. Ohio—Toledo, April 13. Michigan—Lansing, April 18.

Ontario—Toronto, April 23. Missouri—St. Louis, April 5. Iowa—Sigourney, April 17. Wisconsin—Madison, April 14. Minnesota—St. Paul, April 17. Kansas—Lawrence, April 27. Nebraska—Lincoln, April 16. South Dakota—Huron, April 16. North Dakota—Fargo, April 25. Manitoba—Aweme, April 30. Wyoming—Torrington, May 10. Montana—Great Falls, May 14. Alberta—Glenevis, May 5.

Late dates of the departure of spring transients are: North Carolina—Weaverville, May 12. Virginia—Charlottesville, May 31. District of Columbia—Washington, May 13. Pennsylvania—McKeesport, May 20. New York—Rochester, May 26. Massachusetts—Boston, May 21. Vermont—St. Johnsbury, May 28. Tennessee—Knoxville, May 31. Kentucky, Bowling Green, May 20. Illinois—Yorkville, June 1. Ohio—Austinburg, May 31. Missouri—Montgomery City, May 21. Iowa—Independence, May 26. Wisconsin—Madison, June 1. Nebraska—Stapleton, May 12. South Dakota—Sioux Falls, May 25. North Dakota—Fargo, May 24.

Early dates of fall arrival are: North Dakota—Fargo, September 7. Wisconsin—Ladysmith, August 24. Iowa—National, August 31. Michigan—Sault Ste. Marie, August 9 (bird branded). Illinois—Chicago, August 30. Indiana—Waterloo, August 31. Ohio—Leetonia, August 28. Kentucky—Bowling Green, September 4. Mississippi—Bay St. Louis, September 25. Louisiana—New Orleans, October 24. New Hampshire—Hanover, September 8. Massachusetts—Monterey, September 1. New York—Rochester, September 4. Pennsylvania—Doylestown, September 6. District of Columbia—Washington, September 4. West Virginia—Bluefield, August 28. North Carolina—Chapel Hill, September 11. South Carolina—Marion, September 2. Georgia—Atlanta, September 12. Alabama—Anniston, October 8. Florida—Fort Myers, September 4. Bahamas—Nassau, October 1. Cuba—Habana, September 20. Dominican Republic—Ciudad Trujillo, October 5. Puerto Rico—Guanica Lagoon, October 24.

Late dates of fall departure are: British Columbia—Buskwa River, near Fort Nelson, September 16. Alberta—Glenevis, October 10. Montana—Great Falls, September 18. Wyoming—Laramie, November 14. Manitoba—Aweme, October 13. North Dakota—Argusville, October 16. South Dakota—Lake Poinsett, September 27. Minnesota—Minneapolis, October 11. Wisconsin—Elkhorn, November 3. Iowa—National, October 22. Missouri—Montier, October 17. Ontario—Moosonee, September 24; Port Dover, October 25. Michigan—Calumet, September 29. Illinois—Urbana, October 31. Indiana—Indianapolis, November 16. Ohio—Toledo, November 11. Kentucky—Versailles, October 27. Newfoundland—Tompkins, October 4. Prince Edward Island—North River, September 15. Quebec—Hatley, October 16. New Brunswick—Scotch Lake, October 29. Nova Scotia—Yarmouth, October 15. Maine—Portland, October 27. Vermont—Wells River, October 27. Massachusetts—Martha's Vineyard, November 21. New York—Orient, November 18. Pennsylvania—Jeffersonville, November 13. District of Columbia—Washington, November 20. West Virginia—Bluefield, November 15.

Banding.—While not many palm warblers have been banded, a few interesting records have been obtained. A western palm warbler was banded on October 9, 1932, at North Eastham, Cape Cod, Mass.; and seven weeks later, November 28, 1932, it was caught in a house at Point Verde, Placentia, Newfoundland, almost 900 miles northeast of the place of banding.

A yellow palm warbler banded at Elmhurst, Long Island, N. Y., on October 13, 1932, was found on January 15, 1933, at Dunn, N. C.

A palm warbler banded at Homosassa Springs, Fla., on March 29, 1936, was recaptured at the same station on April 6, 1941. Another banded at Coral Gables, Fla., on January 17, 1943, returned to the station the following fall on October 26.

Casual records.—A palm warbler was collected at the west base of the Steens Mountains in Oregon on September 26, 1913. Two specimens have been taken in California: at Pacific Grove on October 9, 1896, and on the shore of Ferguson Lake, Imperial County, on September 22, 1942. One was collected in Baja California, at Chapala, on October 16, 1930. A specimen collected September 18, 1915, at Bernard Harbor, on the shore of Dolphin and Union Straits, Mackenzie, is the northernmost record to date.

The palm warbler has twice been recorded in Colorado: one was observed in Denver on June 20, 1891, and a specimen was collected at Limon, Lincoln County, on May 13, 1947. In Otero County, N. Mex., near the White Sands National Monument, a lone palm warbler was collected on December 6, 1935. Several specimens have been collected in Bermuda: December 17, 1847; December 3, 1848; September 4, 1899; October 3, 1902; November 14, 1903; and March 15, 1937.

Egg dates.—Alberta: 6 records, May 30 to June 16.

New Brunswick: 16 records, May 28 to June 21; 10 records, June 3 to 9.

Nova Scotia: 20 records, May 18 to June 8; 15 records, May 20 to 31.

Quebec: 17 records, June 5 to July 1; 13 records, June 7 to 15 (Harris).

DENDROICA PALMARUM HYPOCHRYSEA Ridgway

YELLOW PALM WARBLER

Contributed by Winsor Marrett Tyler

Plate 56

HABITS

We may suppose that the yellow palm warbler has been moving up and down the Atlantic coast on its migrations to and from Canada for many years, perhaps since the glacier retreated and opened the road to its breeding-ground some 15,000 or 20,000 years ago, but it is only recently, a little more than two generations ago, that ornithologists have recognized that the bird was distinct from the palm warbler which breeds and migrates farther toward the west. Robert Ridgway (1876) called attention to a marked difference in the plumage of the migrant palm warblers taken in the Mississippi Valley and those from New England and southward. He pointed out that the latter birds were uniformly bright yellow below, streaked, especially on the sides, with chestnut, and that the back was "greenish-olive," whereas the western birds were yellowish-white beneath, only tinged with yellow, except on the throat and crissum where they were clear yellow, while the entire breast was streaked with brown, and the back was "dull olive-brown." The eastern birds were also slightly larger in all dimensions.

The eastern form was accepted as a subspecies of the palm warbler and appears in the first edition of the A. O. U. Check-List (1886) as *hypochrysea*, golden beneath. Subsequently it was found that the breeding ranges of the two races lie chiefly in Canada, roughly to the east and west respectively of the longitude of the southern tip of Hudson Bay.

Of the older writers, Wilson and Nuttall, who studied chiefly the birds of the northeastern United States, apparently met only the yellow palm warbler, and Audubon definitely describes it, but his remarks on the birds he saw commonly in Florida throughout the winter without much doubt apply to the western race.

Spring.—The yellow palm warbler, in spite of its small size and fragile appearance, is evidently a hardy bird. It pushes northward into New England early in April when winter is not far behind us, at a season of uncertain weather, with perhaps even snow, and before many of the leaves have expanded fully. The bird passes through the Transition Zone a full month before the horde of north-bound migrant warblers which brighten the treetops in mid-May; it comes even earlier than the robust myrtle warbler which has wintered not far away; and before the black and white creeper which feeds from the bark of tree trunks and branches. Only the pine warbler, returning to its home in the evergreen pitch pines, precedes it by a few days.

Those who watch the arrival of the migrant birds carefully often note that the migration of the yellow palm warbler coincides almost exactly with that of the hermit thrush and the ruby-crowned kinglet. Year after year these three birds appear on the same day, or thereabouts. The birds are not closely related to one another but they possess a trait in common: they do not depend for food on the insects found solely in widely opened flowers and leaves. Both the thrush and the kinglet are accustomed to the wintry conditions of the southern States. In April the hermit feeds on the ground among the fallen leaves; the kinglet must find most of its food in conifers or on the bare branches of trees and shrubs and in their swelling buds; and the yellow palm warbler feeds to a large extent on the ground, often in the recently burned-over patches of grassland common at this season. Here it hops about in the black, parched grass, searching for insects or seeds in the company of the robins, cowbirds, grackles, chipping sparrows, savannah sparrows, and other birds which are attracted to these areas. William Brewster (1906) says of the bird:

> Yellow Palm Warblers visit the Cambridge Region [Mass.] with unfailing regularity in spring and autumn, although their numbers vary greatly from year to year. Sometimes only a very few are reported, but in spring they are usually common and occasionally really abundant. On April 25, 1868, during a brief but heavy snowstorm, I found them by hundreds at Fresh Pond where, in company with an even greater number of Yellowrumps, they had congregated on a narrow strip of bare, pebbly beach at the water's edge. It is of course exceptional to see anything like so many together, but one may often meet with fifteen or twenty in a single flock or forty or fifty in the course of a morning walk.

Nesting.—The yellow palm warbler breeds in portions of Ontario, Quebec, southern Nova Scotia, southern New Brunswick, and in northern Maine. It frequents the sphagnum bogs and open barrens of these regions, building its nest on the ground or, more rarely, on low branches of small spruce trees. Robie W. Tufts (MS.), in his notes on 61 nests found in Nova Scotia, says: "The usual number of eggs to a nest is 5. I have never found a full set with fewer than 4, nor more than 5. May 20 would appear to be the average date for a complete set of the first laying, but I have reason to believe that the birds frequently, if not regularly, raise two broods. The nests are usually built on the ground on open barrens, well concealed under the dried brakes of the previous year's growth, although frequently they are hidden away among the roots of spruce seedlings. About 1 nest in 20 is likely to be found from 1 to 4 feet above the ground close to the trunk in a small spruce seedling."

W. J. Brown has sent to A. C. Bent descriptions and photographs of nests found in the southern part of the Province of Quebec. Here the birds breed in "large tracts of open sphagnum bogs," often among the lichens which cover the ground, in situations such as the following: "at the base of a seedling spruce; sunk under a clump of cotton grass; embedded in a mass of bleached grass at the side of a mound, concealed in lichens and low plants; 6 inches from the ground in crotch of seedling spruce in center of large sphagnum bog among a thin growth of spruce; 2 feet above the ground against the trunk of a small spruce tree, at the edge of an open sphagnum bog." The nests were made of dry grass and lined with feathers.

P. B. Philipp and B. S. Bowdish (1917) found the bird breeding commonly in New Brunswick in situations similar to those mentioned but "one small breeding colony were nesting on high, dry ground, in a grove of small pines." They describe a nest as "composed of fine dead weed-stalks, strippings of dead weed bark and dead grasses, lined with the finest of same material, and with a few feathers worked into lining. The feathers in nest lining seem to be characteristic of this bird." They give the dimensions of a nest as "diameter outside 3½ inches and inside 2 inches with a depth of 2½ inches outside and 2 inches inside." They remark: "The sitting Yellow Palm Warbler usually runs, mouse fashion, from the nest, while the intruder is still some feet distant, and it is with greatest difficulty and the most acute watching that this movement is detected soon enough to serve as a clue to the immediate whereabouts of the nest. The bird remains silent until well away from the nest, usually until the intruder has been in the vicinity for a few minutes, when it commonly begins a vigorous chipping, the sharp, strong note characteristic of the species."

Ora Willis Knight (1904) discovered the yellow palm warbler breeding near Bangor, Maine, in a bog similar to the bogs in the localities mentioned. He says it "consists of large open expanses thickly carpeted with sphagnum mosses, and dotted with numerous small trees and shrubs." Among the characteristic plants, he mentions hackmatack, swamp spruce, Labrador tea, rhododendron, swamp laurel, wild rosemary, birch, orchids, and many sedges. Knight (1908) says, speaking of the same region:

> Nest building must begin early in May, as well grown young have been found the first of June. I am satisfied that both parents share in the duties of incubation and both take part in caring for the young. The nests can be easily located by watching the parents carrying food to the young, but before the eggs have hatched the birds are very shy of approaching the nest when observers are about. The incubating bird will remain on its nest until almost stepped upon before flying, and practically the only way of discovering nests is by flushing birds therefrom, unless some reckless person is willing to visit the bog and spend day after day during the nest building season, fighting the voracious mosquitoes and meanwhile watching to catch the birds in the act of carrying ma-

terial to the nest. * * * While Maine is the only State where this species has been found nesting, I would be inclined to predict that careful search of suitable localities in northern New Hampshire and Vermont will show that they nest there also.

Eggs.—The eggs are practically indistinguishable from those of the western palm warbler, as described under that subspecies. The measurements of 40 eggs average 17.4 by 12.9 millimeters; the eggs showing the four extremes measure **19.0** by 13.1, 18.0 by **13.8**, **16.0** by 13.0, and 16.7 by **12.5** millimeters (Harris).

Young.—O. W. Knight (1904) says that the young yellow palm warblers "leave the nest within twelve days after hatching," and after hiding a day or so in the undergrowth are able to essay short flights. Frank L. Burns (1915b) gives the incubation period as 12 days.

Plumages.—[Author's Note: Dr. Dwight (1900) describes the juvenal plumage, in which the sexes are alike, as follows: "Above, dull sepia-brown, streaked with clove-brown. Wings and tail clove-brown, edged chiefly with dull olive-green, the coverts and tertiaries with drab cinnamon-tinged; the outer two rectrices with terminal white blotches on the inner webs; no definite wing bands. Below, including sides of head, dull white with dusky spots and streaks; chin and crissum faintly tinged with yellow. Orbital ring dull white; transocular streak dusky."

A partial postjuvenal molt occurs in August, involving the contour plumage and the wing coverts, but not the rest of the wings or the tail. In his first winter plumage, the young male is "above, yellowish sepia-brown, yellowish olive-green on the rump and upper tail coverts, obscurely streaked with dull clove-brown, the crown merely tinged with concealed chestnut. Wing coverts clove-brown edged with olive-green and tipped with cinnamon *not* forming wing bands. Below, canary-yellow brightest on the crissum, obscurely streaked on throat and sides with dusky chestnut everywhere veiled by overlapping whitish edgings. Superciliary line canary-yellow, orbital ring buffy white; transocular streak dusky."

The first nuptial plumage is acquired by a partial prenuptial molt, "which involves chiefly the crown, sides of head, chin and throat and not the rest of the plumage. * * * A rich chestnut cap is assumed, contrasting sharply with the worn feathers of the occiput, the lores become dull black, the auriculars chestnut and the yellow of the chin and breast becomes brighter with rich chestnut streaks on the sides of the throat and breast. The streaking of the sides of the chin and across the jugulum are darker. Elsewhere a few stray feathers are acquired." Dr. Dwight saw this molt in progress in December and January in birds from Jamaica, in March and April in birds in Florida and Georgia, and late in April in birds near New York City.

A complete postnuptial molt in August produces the adult winter plumage, which "differs little from the first winter dress, but of richer brown above with darker wing edgings, the chestnut more abundant on the crown and the streakings below more conspicuous." Adults have a partial prenuptial molt in the spring, as in the young birds.

Of the females he says: "The sexes are very similar in all plumages, females usually a little browner and with less yellow. In first winter plumage with very little or no chestnut on the crown and later practically indistinguishable, but undergoing the same moults as the male, the prenuptial more limited."]

Food.—Ora W. Knight (1904), who studied the bird on its breeding grounds, says: "The food of this species consists largely of insects and among the contents of stomachs of birds taken in spring and summer have been found small beetles, gnats, mosquitoes, flies and the general run of small insects found on the trunks of trees or flying in the air in localities which the Warblers frequent. In late summer and fall some small amount of vegetable matter is also eaten, chiefly unidentifiable plant seeds." To this list Forbush (1929) adds mayflies, leaf beetles, ants, plant lice, and grasshoppers, and remarks: "On Cape Cod it apparently eats bayberries in winter, like the Myrtle Warbler."

Francis H. Allen (MS.) speaks of "two birds on the upper beach at Ipswich, Mass., among the beach grass, feeding on flies, which they often caught on the wing. They would squat against the bank with tail resting on the ground and look about for insects and then make a sudden run or leap into the air after one."

I have seen the birds hover beside a branch and pick off insects from it.

Behavior.—The yellow palm warbler is an inconspicuous little bird, almost insignificant; it flashes no bright color, like the redstart; it has no loud, striking song, like the yellow warbler. Indeed, few people ever see the yellow palm except those who are familiar with this tiny, pale yellow, chestnut-capped, tail-wagging, quiet bird—those who are on the watch for it as it passes unobtrusively up and down the Atlantic seaboard.

Nevertheless, it is a common bird early in spring in New England and the southern States, one of the first warblers to arrive from the south. We may see it, often in groups of half a dozen together, flitting among the shrubbery bordering the country roadsides, along stone walls, or feeding on the ground out in open fields, singing its faint song, and wagging its tail up and down wherever it goes. Delicate and fragile as the bird seems, it is journeying to a wild country to spend the summer in the cold, dank, mossy swamps far away in the north. During its migration, too, it seems attracted to moisture, to wet hollows in the woods and to the edges of streams and ponds. I have seen it feeding on the surface of a brook, held up by heavy grass lying along the water.

The bird is even commoner in the autumn migration but is no more conspicuous, for at this season, September and early October, it is moving southward in company with many other species of migrant warblers.

Francis H. Allen (MS.) reports an interesting habit of the yellow palm which he noted as he watched two birds catching flies on Ipswich beach, as previously described: "They were very active, running and hopping along over the sand. They progressed both by hopping and by running, as I saw both by watching them and by observing their tracks, but they hopped more than they ran, and they always hopped when they had longish distances to go. I watched them for a long time and was often very near them, even within 8 feet. They did not seem at all afraid of me."

Voice.—The song of the yellow palm warbler is one of the so-called trills, so common in bird music, a series of short notes rapidly repeated. Sometimes the notes are inflected slightly, giving them a doubled effect. It is an inconspicuous little song, no loud or accented notes, the tone rather flat, with no ringing quality—a feeble jingle made up of listless notes, usually all on the same pitch and with little musical charm. Walter Faxon used to say that it suggested to him the song of a debilitated chipping sparrow.

As I have listened to the bird's singing over a series of years I have sometimes noted a variation both in the delivery and quality of the song. There may be a slight swell in the middle, and on one occasion I heard it divided into short sections like the early morning singing of the chipping sparrow. Rarely, the notes are uttered slowly, no faster than a flicker's *shouting*, and while they are usually uttered with no suggestion of vigor, occasionally they are given with such a sharp, staccato delivery that they suggest (in the delivery only) the bright song of Wilson's warbler. When the pitch alternates up and down with a hint of *rotary* effect, as it does in some instances, the song might be confused for a moment with that of a myrtle warbler, singing very listlessly. The palm warbler's call note is feeble, but sharply-cut at the end, suggested by the syllable, *ship*.

Aretas A. Saunders (MS.) sends to A. C. Bent this analysis: "The song of the yellow palm warbler is a simple one, consisting of 10 to 30 notes in regular, even time, and with only slight changes in pitch.

The quality is only slightly musical and is distinctly sibilant or fricative, with sounds like the consonants *s* or *f* running all through it. It is not loud, and none of the notes is strongly accented. The average number of notes per song is 16. Of 15 records of this song, 5 are made up of single notes, 3 of 2-note phrases, while 7 begin with 2-note phrases and end in single notes. Changes in pitch average about a tone, a few songs being all on one pitch, and only 2 changing more than one and a half tones. The pitch, I believe, ranges from A flat '''' to D'''', a range of only 3 tones. Songs range from 1⅕ to 2⅗ seconds in length. The number of notes per second varies from 8 to 12."

The bird sings freely in New England during its northward migration, but I do not recall ever hearing the song in Florida in early spring.

Field marks.—The distinctive mark of the two races of the palm warblers is their chestnut crown. The wagging tail of the palm warblers, an almost constant movement, is a pronounced up and down sweep, through a much longer arc than the twitching tail of the blackpoll and the prairie warblers. The two subspecies of the palm warbler are very similar in plumage. The most reliable point of difference is the contrast in color between the yellowish-white breast and, by comparison, the intense yellow of the under tail coverts in the western race, a contrast the yellow palm lacks, its under parts being uniformly yellow. In the autumn, when the colors are fainter, it may sometimes be impossible to identify the races surely in the field.

Enemies.—Aside from the hazards to which its ground nests are exposed and the dangers of its fairly long migration at the seasons, both spring and fall, when the Accipiter hawks are moving, the yellow palm warbler has no especial enemies as far as we know.

Herbert Friedmann (1929 and 1934) says it is "a rare victim" of the cowbird, and cites only four nests in which cowbirds' eggs have been found.

Fall.—The yellow palm warbler is often an abundant bird during its fall migration along the Atlantic coast, generally frequenting the birch thickets where plant lice abound, a favorite food of the autumn warblers. Dr. Charles W. Townsend (1905) says: "On October 14th, 1900, in a violent northeast storm with rain, I found the Ipswich dunes swarming with these birds."

Winter.—Few yellow palm warblers leave the United States during the winter. They are rare in Cuba (Barbour, 1943). Their chief range in winter is in the Gulf States from Louisiana to Florida, but in the latter State it is almost exclusively restricted to the west coast. Hence its winter range is decidedly more to the westward and much farther north than the range of the western race.

SEIURUS AUROCAPILLUS AUROCAPILLUS (Linnaeus)

EASTERN OVENBIRD

CONTRIBUTED BY ALFRED OTTO GROSS

PLATES 57, 58

HABITS

The eastern ovenbird is an inhabitant of the woodlands and, during the breeding season, is one of our commonest and one of the most interesting warblers of our hardwood and coniferous forests. Because of its loud *staccato*, with its *crescendo* ending, its somewhat mysterious and secretive habits in the underbrush and on the leaf-covered floor, and because its well-concealed nest is so different from that of the other warblers, it is often one of the chief objectives of those in quest of unusual bird lore on strolls through the woods in May and June.

The names that have been applied to this bird emphasize some of the traits and markings of this most individualistic of all our warblers. The generally accepted common name, ovenbird, was adopted because of its peculiar nest that resembles a miniature Dutch oven. The song has given origin to the names teacher-bird and accentor; the peculiar vibratory motion of its tail and body when walking has suggested the names wood-wagtail, wagtail warbler, as well as the generic name *Seiurus*. In Jamaica it is commonly known as the land-kickup; in Florida the natives call it the night-walker, thus calling attention to its method of locomotion by walking rather than by hopping. Its golden-brown crown mark is revealed not only in the species name *aurocapillus* but also in the common name golden-crowned warbler and this marking is also coupled with other characteristics in such names as golden-crowned wagtail, golden-crowned accentor, and golden-crowned thrush.

Spring.—In the spring migration the first arrivals appear on the mainland of Florida in March, single individuals have been noted during the first week, but the migration in that State extends through April to May. The average date of arrival in North Carolina, Virginia, and Washington, D. C., is April 24–26. They reach Pennsylvania, New York, and southern New England during the first week of May, by the second week of that month they can be expected in Maine, and by the third week they reach New Brunswick and Nova Scotia, arriving in Quebec during the first week of June.

The dates of arrival in the Mississippi flyway are earlier than for the same latitudes in the east. The first individuals reach Kentucky on April 10, with extremes as early as April 3. They reach Michigan by April 27, Iowa by April 29, Minnesota by May 7, by mid-May they are in Manitoba and Alberta, and by the end of May they are at their outposts of range in Alaska.

The ovenbird arrives on its breeding grounds in the spring with great regularity, and there is much less variation in the date of arrival from year to year than is exhibited by many other birds. It appears at a certain point regardless of the weather, be it warm and summer-like, freezing, or snowing. The coming of the ovenbird is so definitely announced by its loud and easily recognized song that a factor in its apparent punctuality may be its being promptly recorded. In my own experience I more frequently hear than see the first arrivals in spring.

Harry W. Hann (1937) has clearly established by banding and careful detailed observation—

> that both male and female adult birds return to their old breeding grounds, if possible. Old males have a good chance of obtaining their former territory either by arriving early or by driving out the other males. Returning females have more difficulty, however, since females probably return at more nearly the same time, and there is the additional factor in their adjustment, with the male. It seems obvious, though it was not actually observed, that the female goes first to the old territory, and if the male there already has a mate, she goes to an adjoining territory. The particular male in the territory seems to be of no consequence.
>
> With both males and females attempting to return to the same place, there would seem to be a strong tendency for the pairs to remate in subsequent years, and this happened twice with banded birds.

Courtship.—The courtship of the ovenbird, a most interesting and remarkable affair, is intimately associated with the male's extraordinary musical performance. One may see the birds walking casually over the leaves of the forest floor, making scarcely a sound, then through some sudden impulse the male starts after the female in a frantic pursuit often terminated by a wild flight, during which he pours forth a loud and eloquent love song. After this flight he returns to the forest floor to sing his ringing "teacher" notes. Morris Gibbs (1885) gives us an excellent account of this unusual courtship of a pair of birds he observed near Grand Rapids, Mich.:

> Carefully crawling through the almost impenetrable growth of small saplings and brush, I came at last to a partial clearing over which a bird, apparently in the highest transports of joy, was fluttering in irregular flight. * * * I observed another bird undoubtedly its mate, perched on the ground near, and which appeared to be a Golden-crowned Thrush and the centre of attraction to the delightful warbler overhead. Never had I heard the song before, and never have I witnessed such a scene. This was indeed making love with a spirit which I have never witnessed among our birds before. The song was almost continuous, and with an occasional interruption to the new song by the common chattering notes so well known and described by Coues as a "harsh crescendo," the notes were all of the most melodious description. The energetic uncon-

scious fellow was meanwhile constantly flying about his inamorata, describing every form of flight except that of regular sailing; first dashing through space to the edge of the glade, which was probably twenty feet across; then rising to the tops of the bushes, he would half flutter, half fall towards his prospective mate. On a sudden he would flutter directly upward as we often see the English Sparrow or House Wren do, and on reaching a height of twenty feet or more, dash about the clearing in varying circles, ever tending in his flight toward the object of his extravagant attention. She in the meanwhile sat silent and evidently interested in the performance. Suddenly the male dropped beside her, and alternately dashing and wheeling about, but continually on the move and always revolving about her, gave evidence of his adoration by a series of hops, dignified struts, droppings of the head and tail, elevation of the wings and crest, which would have done credit to both the Turkey and the Ruffed Grouse. While on the ground the song was kept up with the usual vigor, but the interruption by the coarser, common notes was more frequent and the bird stopped in its struts in order to utter the notes which apparently caused him more effort than did the more beautiful song. The appearance of a third party on the scene, probably also a lover, caused the first performer to dash into the brush much to my disappointment.

Nesting.—The ovenbird nests in woodlands, usually where the underbrush and growth of shrubs and small trees is scanty, and the forest floor is open below and carpeted with old leaves. Here it lives in company with such birds as the true thrushes and the whippoorwill. The nest is generally located in open situations on the forest floor, allowing an approach to it from any direction, though at times a tree or shrub may be standing behind or at one side of it. In one case the nest was found built in the end of a large pine log and partially concealed by a growth of ferns. The majority of the nests are located alongside trails or woodland roads, or in partially cleared places where at certain times of the day the light can filter through. These open areas are probably an advantage to the birds in approaching their nests, certainly they are a convenience to the naturalist who wishes to observe or photograph them. I know of no case where the ovenbird has departed from its habit of nesting on the ground.

The typical nest is constructed of dry grasses, vegetable fibers, leaves, leaf and weed stems, rootlets and bits of bark, and moss. It is lined with finer materials, tiny rootlets and fibers, and varying amounts of hair. Sometimes the nest may be made almost exclusively of one material. T. S. Roberts (1936) describes and figures a nest made up entirely of fine bleached grasses very different from the usual leaf-studded structure. In nests that I have found in the pine woods of Maine pine needles made up the bulk of the structure.

The nest is generally built in a slight depression of the ground and is invariably covered over; often the leaves of the leaf-bed and the branches of small, fallen, dead trees extend over the nest at the sides and back, making a roof that sheds rain as well as conceals the nest from view. Indeed the nests are so well hidden that they are difficult to find except by flushing the bird; this often occurs by accident.

Miss Cordelia Stanwood, in an unpublished account, describes a nest and a nesting site of an ovenbird near Ellsworth, Maine, as follows: "The cavity in the ground in which the nest was located was about 1 inch deep in the center. Around the edge of the excavation were maple leaves, and pine needles. The ground was swampy, covered with sphagnum moss, white birch and maple leaves, sensitive and New York ferns. The nest was located among maples and white birches adjoining some evergreens. The growth was thick overhead but open underfoot. The saucer part of the nest, level with the ground, was made of pine needles and dead leaves. It was roofed over with pine needles, dead leaves, fern, moss, stipes of ferns and bracken, and the fruit stems of maples; it was nicely lined with horsehair. Two sensitive fern fronds had grown through the nest, and the little mound of dry leaves and moss was in no wise distinguishable from its surroundings."

The width of the nest averages about 6½ inches but the leaves and nesting materials may extend for about 9 inches. The height of the nest ranges from 4½ to 5 inches. The cavity is small as compared to the exterior, usually measuring less than 3 inches in diameter. The opening is about 1½ inches high and 2¼ inches wide.

The female is responsible for selecting the nesting site and for building the nest. While the female is busily engaged in building, the male lends moral encouragement by singing; he guards the territory and gives the alarm whenever an intruder appears. He seldom visits the nest during the course of construction but is a constant attendant and assists in feeding the young after they appear. According to H. W. Hann (1937):

> The female clears the leaves from a circular spot, by pushing them back, raising up the edges, and perhaps removing some. She then, in some cases, digs up the ground, leaving fresh soil on the surface, and may remove some soil or push it aside. * * * Nesting material is then carried and placed around the edge of the hole, chiefly on the back side, and the covering is extended over the top. The work is done almost entirely from the inside, but evidently a few leaves are placed on top and arranged from the outside. * * * The last material to be added to the nest is the hair, and the presence of this indicates a finished nest. The hair is often added a day or more after the remainder is finished, and doubtless causes the female considerable searching.

Ovenbirds will sometimes desert their nest when disturbed, especially at the time when the nest is under construction or the eggs in the early stages of incubation. However, in correspondence received from Dr. Paul Harrington, he reports flushing a bird from a nest at Birch Point, Toronto, in which the whole dome or top had been torn off (probably by cattle) and carried about 10 feet away. The bird continued incubation apparently unconcerned by its exposed condition.

Eggs.—The eggs are laid during the morning, often before sunrise, 1 to 3 days after the nest is completed. Under normal conditions an egg is laid each day until the set is completed. The number in complete sets varies from 3 to 6 eggs. In 36 nests not disturbed by cowbirds, J. P. Norris (1892) reported 6 with 3 eggs, 13 with 4, 16 with 5, and 1 with 6, an average of slightly more than 4 eggs per set. Hann (1937) in a series of 27 nests in which the eggs were checked as laid there were 2 nests with 3 eggs, 6 with 4, 18 with 5, and 1 with 6, an average of about 5 eggs per nest. If the first attempt at nesting is a failure the second set of eggs is generally smaller in number than the first. Normally the ovenbird does not rear two broods during any one season.

The eggs have a white, slightly glossed ground color speckled and spotted with hazel, lilac-gray, and reddish-brown. In the majority of the eggs the markings form a wreath about the larger end. A series of 50 eggs had an average length of 20.2 millimeters, the extremes being **18.6** and **23.2** millimeters, and an average short diameter of 15.5 millimeters, the extremes being **14.3** and **16.7** millimeters.

Incubation.—Incubation is done entirely by the female and begins the day after the last egg is laid, regardless of the size of the clutch. When incubating, the bird sits with her side parallel to the opening of the nest, her tail bent over her back and usually toward the front of the nest. She changes her position many times during the course of the day, placing her head in the opposite direction, but the axis of her body is always in the same relative position. She exhibits considerable nervousness when about to leave the nest and on leaving does not fly but walks a considerable distance over the forest floor before taking flight.

The ovenbird does not flush from her nest readily, and when walking through the woods I have unwittingly trampled on the edge of the nest before she fluttered out. At this time the bird gave a splendid exhibition of feigned injury; she struggled seemingly helpless along the ground with her wings and tail lowered and the feathers of her crown and back uplifted in an attitude of dire distress. After leading me away for a distance of about 50 feet she arose and flew away triumphantly.

The female during the period of incubation leaves the nest voluntarily for feeding from five to a dozen times during the course of the day; spending from 8 to 17 percent of the total time away from the nest. The first trip occurs soon after daylight, and the lightest incubation is from that time until noon. Late in the evening there is a tendency for her to leave again before settling down for the night. It was found that the time off during the day was roughly proportional to daily temperature changes. In a nest which I had under daily observation at Yorktown Heights, N. Y. I saw the male bird deliver several green larvae to the female while she was on the nest incubating the eggs, but this is not of common occurrence as far as I have been able to determine.

The incubation period of two nests studied in Maine was 12 days. The exact incubation period of 76 eggs in 21 Michigan nests was determined by Hann (1937). He found the time ranged from 11 days and 12 hours to 14 days, with an average of 12 days and 5.6 hours. He states that all the eggs of a clutch including the last had about the same incubation period, and any variation of more than a few hours usually concerned all. He found no difference in incubation time with respect to warm or cool weather.

The eggs may hatch at any time during the day but rarely at night. They are pipped on the day before hatching. The shell cracks at right angles to the long axis of the egg before the shell opens to allow the young to emerge.

Young.—The young at the time of hatching have their eyes sealed shut but they readily respond to sounds as soon as they emerge from the egg. When extending their heads and opening their large mouths they seem to balance themselves by their wing tips and sprawled-out legs. Between feeding the young are brooded by the female, and at this time she is very reluctant to leave the nest, even allowing a person to stroke her feathers.

The male assists in the feeding of the young at the very start, in fact he may be seen at the nest even before the young have emerged, in apparent anticipation of his domestic role soon to follow. The adults walk to the nest in bringing food, usually along well-established routes and runways which in part are concealed from view. They often stop with food in their beaks, when near the nest, and carefully scrutinize the surroundings as if to make sure they are not being spied upon by some intruder. The male, at least at first, seems to be more wary and cautious in this respect than the female when approaching the nest.

By the second day the young reach toward the opening of the nest in soliciting food. At 4 days the eyes of the young are slightly open and the edges of the gapes have assumed a more pronounced yellow. The feather papillae in the various feather tracts show prominently. The young are much more active and move themselves about the nest more readily with the aid of their rapidly growing legs. They are also quicker in responding to the parents arriving with food. Excrement is voided by turning the rear of the body toward the opening of the nest. During the first day or two the excrement is eaten by the adult birds but as the young become older more and more of it is carried away to be dropped at a considerable distance from the nest.

By the fourth day the number of feedings required of the adults has greatly increased over those of the first day. As the young grow older it is not unusual for the adults to exceed a hundred visits to the nest with food in a single day.

The eyes are completely opened by the fifth day, and from then on the young are not easily deceived by false noises or those not concerned with the arrival of food.

After 6 days of nest life the young may be seen going through exercises, stretching their wings to gain strength and, perhaps, partly to relieve an uncomfortable feeling produced by the rapidly growing parts and feathers. They preen themselves a great deal and peck at the bases of the feathers to assist in the unsheathing process. By this time their temperature control has developed sufficiently so that there is less need of brooding by the parents.

By the eighth day the primaries are unsheathed for about three-fourths of their length and the feathers of the other tracts have proceeded to such an extent that the juvenal plumage is well established, giving a more pleasing contour to the young. There is now great competition among members of the brood when the parents arrive with food, and they utter a kind of buzzing call in concert as they stretch their necks and extend their gaping mouths out of the opening of the nest. Sometimes the young may leave the nest at this age, but in some nests I have had under observation they remained a day or two longer.

In leaving the nest the young hop out one at a time, and considerable time generally elapses before all have departed. When a nestling leaves it follows one of the adult birds, and those left behind are cared for by the mate. The parent bird leads the youngster, coaxing it along now and then with food and offering encouragement by responding to its peeps and chirps. Finally each parent goes its own way with its part of the brood, and thus nest life comes to a successful ending. Under favorable conditions young birds, especially those attended by the males, may remain in practically the same territory for several days after leaving the nest.

As soon as the feathers of the wings have completed their growth the young are able to fly when flushed. They usually alight on the ground but sometimes they are able to negotiate a landing and maintain a hold on a shrub or lower limb of a tree. After the young are 3 weeks old they are able to secure their own food although it is still supplemented by the parent birds. When the young are about 5 weeks old they are abandoned by the adults and from then on are on their own. By the time they have undergone the partial postnuptial molt and have acquired their so-called first winter plumage they are physically fit to migrate. The adults generally disappear from the woods as soon as the young can care for themselves.

Polyandry.—Ordinarily the male and female ovenbirds have single mates but H. W. Hann (1937) cites a case where one male had two mates at the same time, and another in which a female copulated with two neighboring males in her own territory, then later visited a neighboring male in his territory during her incubation period. In a later paper Hann (1940) records an observation in which two males as well as the female were carrying food to the young in the nest. After these complicated relations were noted a third male, not banded, appeared on the scene. He repeatedly came near the nest, although chased by the other males. His intent seemed centered chiefly in the female, as he was not seen to feed the young, and apparently, according to Mr. Hann, he was successful in some of his attempts at copulation. Hence this female had three mates, although the third might well be considered an interloper. When the young left the nest the two banded males took charge of one young each and the female cared for the other three.

No one else has made such an intensive study of the family interrelationships of the ovenbird as has Mr. Hann, with the aid of marking and banding the individuals. Polyandrous matings may be more common than has been supposed among species, such as the ovenbird, that we have always thought to be monogamous.

Plumages.—[Author's Note: According to Dr. Dwight (1900), the natal down is "pale sepia brown."

He describes the juvenal plumage, which is partially acquired in the nest, as follows: "Above, including sides of head, cinnamon-brown, sparingly spotted with olive-brown, the dusky lateral stripes faintly indicated on the crown. Wings and tail olive-brown with olive-green edgings, the coverts slightly tipped with pale cinnamon. Below, pale cinnamon, yellowish white on abdomen and crissum, faintly spotted or streaked on the sides of the chin, on the breast and on the sides with olive-brown."

The first winter plumage is "acquired by a partial postjuvenal moult, beginning by the end of June, which involves the body plumage, the wing coverts, and rarely the tertiaries, but not the rest of the wings nor the tail. Young and old become practically indistinguishable." This plumage is similar to the well-known adult spring plumage, except for brownish edgings on the crown, and faint buffy or yellowish tinges on the under parts, the dark stripes being partially veiled with white edgings.

The first and subsequent nuptial plumages are acquired by wear, which removes the light edgings and brightens the plumage.

A complete postnuptial molt for both young and old birds occurs in July.]

Food.—No comprehensive study has thus far been made of the food of the ovenbird. Unlike most of the warblers, this bird is terrestrial in its habits; instead of gleaning its food from the trunks, limbs, and leaves of trees, it rustles about on the ground turning over leaves to scan the leaf mold of the forest floor, where it finds snails, slugs, myriapods, and earthworms as well as the weevils, beetles, aphids, crickets, ants, and spiders which comprise a large proportion of its food. It is also known to feed on moths and caterpillars and more rarely it may catch flying insects on the wing. It takes a few seeds and small wild fruits but these represent only a little more than one-fiftieth of its entire food. In Florida, ovenbirds have been reported as feeding on the red mulberry. In certain sections of its range it feeds freely on grasshoppers and locusts. Junius Henderson (1934) quotes Aughey as finding an average of 18 locusts in each of 6 stomachs of the ovenbird collected in Nebraska. He adds there was an average of 15 kinds of other insects present in each of the stomachs.

Sylvester D. Judd (1900) examined the stomachs of 3 half-grown ovenbird nestlings which contained "beetles of the family Lampyridae and click beetles, caterpillars, moths, spiders and snails."

In watching birds at the nest from a blind, practically all of the food I saw fed to the young during the first 3 days consisted of various small green and brown larvae. After that time I saw the adults bring spiders, snails, earthworms, centipedes, and a number of winged insects such as flies, moths, beetles, and ants to feed to their young.

Miss Cordelia Stanwood saw young ovenbirds feeding on mosquitoes at Ellsworth, Maine. In her notes she writes: "As I started for home, the female crossed my path, and a young bird followed. As I neared the youngster, he stopped to snap up a mosquito. I knelt slowly and held a mosquito, on the tip of my finger to the little fellow. After hesitating once or twice, he snapped it up. Then I put my hand flat on the ground and let the mosquitoes bite. He walked over to my hand, snapping up mosquitoes for a long time. At last he followed a mosquito across the path, and in answer to the chirps of the parent birds wandered in their direction." Miss Stanwood has also observed the young catching black flies.

Dr. Alexander Wetmore (1916) reports on the examinations of the contents of 13 stomachs of ovenbirds collected in Puerto Rico during the months from December to April, inclusive. The animal food of these birds amounted to 62.43 percent and the vegetable material 37.57 percent. He presents further details as follows:

> In all of these stomachs were considerable quantities of gravel, and all animal matter was ground very fine. Weevil remains (4.8 percent) were present in four stomachs taken in April. Other beetle remains (9.63 percent) in eight stomachs were so finely ground that they could not be determined. Ants were eaten by eight birds and form the large amount of 8.5 percent. Other Hymenoptera

made up only 0.4 percent. Orthopterous remains (2.17 percent) include a walking stick, a grasshopper, and others. A caterpillar (0.5 percent) was found in one stomach and spiders (2.33 percent) in three. Snails, in most instances broken up in very small pieces, were eaten by eight birds and amount to 30.17 percent. A single tree toad comprises 0.93 percent and miscellaneous animal matter 3 percent.

The oven-bird is wholly beneficial in its food habits and is remarkable for the large number of ants eaten, as well as many weevils and other beetles. Snails are much relished, and form nearly half the animal food.

Of the vegetable matter contained in these stomachs 36.9 percent was composed of seeds and 0.67 percent may be classed as rubbish. The oven-bird has a strong, muscular gizzard and takes large quantities of sand, so that the seeds are broken and ground until they are fit for digestion. None are of economic value.

Voice.—The ovenbird has the reputation of being the noisiest and least musical member of the warbler group. Its arrival in the spring is made known to us by its loud, clear, sharply accented calls. It generally keeps well concealed in the dense cover of the woodlands and its voice is frequently heard when we may not discover the singer. The song is a ringing crescendo chant which Burroughs has aptly described as "teacher, TEACHER, TEACHER, TEACHER", an interpretation that will definitely distinguish it from that of any other bird. It has been a question whether the first or the second syllable is accented, but now this accent is known to vary.

The call song commonly heard during the nesting season may be termed the territory song, for it is an announcement of the singer's presence to all other birds and a warning to all trespassers. During mating it is often a challenge and may sometimes serve as a battle cry when a rival appears. The birds sing regularly in definite localities and seldom wander, evidently having definite singing trees and territory. The song can be heard throughout the period of incubation, but in my experience it practically ceases after the feeding of the young demands the full attention of both parents. In Maine it is seldom heard after the middle of July. A second period of singing occurs in August or early September but the song at that time is transient and most irregular. In this supplementary period the song is to be heard for only a few days, in the early morning hours, and never reaches the precision and vigor of the true spring song.

In correspondence from Aretas A. Saunders, he states: "The territory song consists of 2-note phrases, 6 to 12, and averaging 8. In each 2-note phrase one is longer than the other, and both are commonly a tone apart in pitch. Each succeeding phrase is slightly louder than the preceding one so that the song is a crescendo throughout. In my 24 records there are various variations from the normal. A few songs vary only a half-tone in pitch, and a few more a tone and a half. Two songs change in pitch in the middle of the song, finishing with phrases a tone higher than those at the beginning. Two songs begin with single notes and end with 2-note phrases, while one begins with 2-note phrases and ends with single notes.

"The pitch ranges one octave, from C sharp ′′′ to C sharp ′′′′. One bird whose song I recorded sang two different songs, the lower one reaching C sharp ′′′ and the higher C sharp ′′′′. The song lasted from 1⅘ to 3⅕ seconds. There is some variation between individuals in the rapidity of singing, some singing about three 2-note phrases per second and others about four. The accented note in the phrases may be either higher or lower in pitch than the unaccented, and my records are about equaly divided in this matter."

Albert R. Brand (1936) has analyzed the songs of birds, including the ovenbird, through a detailed study of film recordings. He writes:

> The speed of bird song was found to be extremely rapid. Many songs that seemed to consist of only a few notes actually contain four or five times as many as the ear can detect, and, in several cases, songs that are assumed to be divided—that is they seem to be made up of several notes—under the microscope were found to be continuous—only one note.
>
> Such was the case of the oven-bird film studied. This song certainly sounds to me, and I imagine to others, as if it consists of a number of separate notes, if not phrases. It is often written, TEACHER. TEACHER, TEACHER, TEACHER, each "teacher" representing one phase or group of notes. But on the film the story is different. The film tells us that this song, which to our ear seems to be made up of a number of phrases, each of which in turn consists of one note that is changing constantly in pitch, is really a continuous note. However, the pitch *is* constantly changing; on that point the ear is correct. * * * The change after the downward movement of the note (flatting) into the higher portion of the song probably causes one to assume that the song is a series of notes, which it certainly is not. Many notes in bird-song were found to be of incredibly short duration, sometimes as short as a hundredth of a second, and the pauses between the notes are even shorter, occasionally only a fraction of that time. It is physically impossible for the ear to distinguish such short notes and intervals; it is no wonder that until the microscopic film studies were made these very short notes had not even been suspected.

In his study of vibration frequencies of passerine bird songs Brand (1938) found that the vibrations per second of the highest note of the ovenbird was 5,850, the lowest 3,300, and the approximate mean about 4,000.

Apparently this song is not peculiar to the male, for Robert W. Hiatt (1943) states that he collected an ovenbird, that was singing as it walked among fallen leaves and branches, which proved to be a female. Whether it is of common occurrence for the female ovenbird to sing is not known, since the sex is difficult to determine without dissection. Better to leave such an academic question unsolved than to collect singing ovenbirds solely for such a purpose!

In addition to the ordinary song, the ovenbird has another song, much more musical and beautiful, generally sung during flight and frequently referred to as the flight song. It is not heard until about

10 days or 2 weeks after the bird's arrival in the spring, it continues through the nesting season, and it normally ceases by the time the ordinary or territory song is no longer heard, although occasionally it has been heard long after the nesting season.

Aretas A. Saunders states: "The flight song is much more variable than the territory song. It is longer, has a greater range in pitch, is sweeter and more musical in quality, and is heard more commonly later in the season. It is often heard in the dusk of evening and I have heard it on a dark night at about 2 a. m.

"I have 15 records of this song. In pitch they range from F sharp ‴ to E⁗. Individual songs have a range from two and one-half to five tones, averaging about three. They occupy from 2⅘ to 4⅗ seconds.

"One can say very little about the form of this song, it varies so greatly. Warbles, 2- and 3-note phrases, slurs, single notes, and twitters are mixed together in various ways. The pitch rises or falls with no regularity. All but 3 of my records have a pause in the middle of the song, 1 record has two such pauses; and 11 contain a few repeated 2-note phrases, like a portion of the territory song, but 4 have no such phrases.

"The bird sings this song in horizontal flight, often above the tops of the forest trees, but sometimes flying through the trees, only 15 or 20 feet above the ground. When a song over the treetop is finished the bird turns about, drops lower and flies back to the starting point through the trees."

The flight song is so truly remarkable that it seems well worth while to present the interpretations of other observers: E. P. Bicknell (1884) writes: "On occasions, as if sudden emotion carried it beyond the restrictions that ordinarily beset its expression, it bursts forth with a wild outpouring of intricate and melodious song, proving itself the superior vocalist of the trio of pseudo-Thrushes of which it is so unassuming a member. This song is produced on the wing, oftenest when the spell of evening is coming over the woods. Sometimes it may be heard as an outburst of vesper melody carried above the foliage of the shadowy forest and descending and dying away with the waning twilight."

Lynds Jones (1900) has called this song of the ovenbird the passion song, which he defines: "It is an outburst of melody of such richness and fullness, such thrilling ecstasy, that the signer is lifted into the air on quivering wings to pour out his melody without a pause until the inspiration has passed. * * * I have seen the ovenbird suddenly vault into the air, mounting to the tree tops on quivering wings, then dart back and forth in a zigzag course swift as an arrow, and finally burst into song as he floated gently down. * * * Sometimes the ovenbird closes his passion song with a burst of the perfect call (territory) song."

H. E. Tuttle (1919) in writing of the night performance of the flight song of the ovenbird states:

> His songs of the noon hour are but jingling alliterations besides the flood of ecstasy that he pours forth above the tree tops in the dark of night. * * * When the starlit nights are warm with the promise of June, then may you hear the first glad upward rush of that far-flung torrent of poetry. Mounting with hurried gladness, as if he feared some surcease of delight, he gains the open sky, spilling the gay notes earthward in his wake, like the tumbling drops of a mountain waterfall. While the last burst of warbled rapture haunts the still air of night, he has sheered into a swift descent, with perhaps a murmured snatch of the refrain, uttered regretfully, as if Lethe had overtaken the singer and hushed the gay chords whilst they trembled from his heart. * * *
>
> Sometimes, even when the sun is high, he falls into a reverie, perched on a horizontal bough above the glade, then, rarely, and but for a moment, as if in a day-dream, the lyric gift is restored. He darts from his perch like a mad thing, and whips through the woods with incredible speed, singing wildly his flight song with all the abandon of a Bacchante, till, as suddenly, he comes to rest upon the branch from which he started, dozes a space, and wakes to walk quietly the length of his perch, returning to the earth as if quite unconscious of what has occurred.

In addition to these songs the ovenbird has an alarm note which is a loud "*tzick*" and on certain occasions utters a softer higher pitched "*tseet.*" Miss Cordelia J. Stanwood describes the calls uttered by the ovenbird when disturbed at the nest as "*cheh! chip! sptz! sptz! sptz! sptz!*" and that of a bird suddenly surprised as "*chip-ip-ip-ip.*"

Enemies.—The ovenbird, as in the case of other ground nesting birds of the forest, suffers from the depredations of snakes, squirrels, skunks, weasels, and other prowlers. William Brewster (1936) gives us a very graphic account of ovenbirds and a black snake which he observed on June 21, 1886, as follows:

> A low but unusual chirping attracted my attention. The sound steadily became more distinct and its authors—for there were evidently several—were plainly advancing toward me. I soon made out they were Oven Birds and that they were on or near the ground, which although free from underbrush was nevertheless well shaded by an abundant growth of sarsaparilla.
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> Finally the dry leaves began to rustle and the sarsaparilla stems to wave directly in front of my position and the next moment a black snake about three feet long emerged into an opening, gliding swiftly and in a perfectly direct course. On each side of the slightly raised head and within less than two feet of it, walked a pair of Oven Birds, their bills open and panting, their wings slightly raised and quivering so rapidly as to produce a hazy appearance above their bodies. They kept their distance exactly and, when the snake stopped they stopped also, apparently not looking at him but facing directly ahead. They were also seemingly ignored by the snake, although he doubtless kept a not less keen side watch on them than they did on him. The entire group, which finally halted within less than ten yards of me, presented a remarkable, not to say ludicrous spectacle and at once suggested the idea that birds were in trained attendance on the snake—a well-drilled escort, as it were, to guide or guard him during his morning crawl. I ended what was likely enough to prove a tragedy to the birds by shooting the snake.

H. W. Hann (1937) reports that a pair of adult ovenbirds exhibited great concern and were annoyed by two barred owls which were in the vicinity of a nest. An owl feather found near a freshly destroyed nest was evidence of this predator. Mr. Hann also gives an account of the red squirrel in relation to nesting ovenbirds as follows:

> The loss of many eggs and young was attributed to the red squirrel. In a number of cases a part of the contents of a nest disappeared, and later the remainder was taken at one or more visits. At one nest, three out of four eggs disappeared just before noon, and I decided to watch for the robber to return. I remained until dark, and returned early the next morning. About 6:00 a. m. a red squirrel came to the nest, got the remaining egg and started off with it. When I approached, it ran up a tree and ate the egg, holding it in its paws as it ate. At another nest which contained a Cowbird nearly ready to leave, a red squirrel suddenly appeared on a tree, head downward, just above the nest. It hesitated a moment until the cowbird gave the food call, then seized it by the head and ran away with it. Red squirrels evidently discover nests by accident, as they run about looking for food. The Oven-birds often chase them away from the vicinity of nests, or the loss would be greater.

Mr. Hann also found evidence that gray squirrels and possibly that skunks and raccoons had destroyed nests he had under observation.

Miss Cordelia Stanwood found a nest of the ovenbird in which one egg had been sucked, and the other was so smeared with the albumen of the first as to be very sticky. Several hairs of a weasel glued to the egg gave evidence of the predator.

There are numerous reports that many ovenbirds are killed by striking lighthouses and towers during their migration. The light keeper at Fowey Rocks, Fla., reported to W. W. Cooke (1904) that he could have filled a mail bag with ovenbirds that struck the lighthouse on October 10 and 11, 1891.

Harold S. Peters (1936) has found five species of external parasites infesting the bodies and plumage of ovenbirds as follows: two lice, *Menacanthus chrysophaeum* (Kellogg) and *Myrsidea incerta* (Kellogg); two ticks, *Haemaphysalis leporispalustris* Packard and *Ixodes brunneus* Koch; and the mite *Liponyssus sylviarum* (Canestrini and Fauzago).

Since the ovenbird is a bird of the forests and builds a nest covered over and well concealed, it would not be expected to be greatly molested by the cowbird, yet it is quite commonly parasitized in certain sections of its range. In Iowa, Lynds Jones (1888) states that every nest of the ovenbird he found at Grinnell contained two or more cowbird's eggs. Isaac E. Hess (1910) found an ovenbird's nest in central Illinois with seven eggs of the cowbird and none of the rightful owner. J. P. Norris (1892) in a series of 40 nests taken in the east chiefly from Maine to North Carolina reported 4 nests, 3 from Pennsylvania and 1 from Connecticut, which contained cowbird's eggs.

In Ohio, Lawrence E. Hicks (1934) found 41 nests out of 112, or 36 percent, parasitized by the cowbird. According to Sage, Bishop, and Bliss (1913) 11 outof 30, or nearly 37 percent, of the nests found in Connecticut contained eggs of the cowbird. H. W. Hann (1937) reports that 52 percent of those he found in southern Michigan were parasitized. Herbert Friedmann (1929) had over 150 records of parasitized ovenbirds' nests ranging from southern New England, New York, Pennsylvania and west to Illinois, Minnesota, and Iowa. In contrast it is interesting to note that of 15 ovenbirds' nests I have seen, and of many others reported in Maine, not one contained cowbird's eggs. Although the cowbird is an abundant bird in that State the ovenbird seems to be comparatively free from molestation in this part of New England.

According to Hann (1937) the cowbird lays early in the morning before the ovenbirds lay and requires only 40 to 60 seconds to deposit the egg. In 13 cases an egg of the ovenbird was removed by the cowbird before the latter deposited an egg, and the number of eggs thus removed was 75 percent of the number of cowbirds' eggs laid. The ovenbird seems to make no attempt to remove the cowbird eggs. The incubation of the cowbird's eggs averaged 11.6 days which is 0.6 of a day less than the average period of the ovenbird. Young ovenbirds in parasitized nests grew approximately as well as those in non-parasitized nests, so that the chief loss to the ovenbird was in the removal by the cowbird of an estimated 18 percent of the total number of eggs laid by the parasitized ovenbirds. However, the survival rate of the cowbirds was low, since out of 40 cowbird's eggs laid, only 22 hatched, 10 birds left the nest, and probably not more than 5 left the woods.

Fall.—Early in August ovenbirds are to be seen just south of their breeding range, indicating that the autumn migration has started. The earliest recorded dates for the Carolinas are in the first week of August. They reach southern Florida by August 20 and by the end of August the first fall migrants arrive in Cuba and Puerto Rico. The bulk of the individuals do not pass over this route until a month later. From mid-September to mid-October waves of these warblers are to be seen passing through and leaving the Florida Peninsula.

The last individuals leave Manitoba, Ontario, New Brunswick, and other sections of these parts of the northern nesting range by the last week of September. In the northern States of the Middle West and in New England they leave by the first week of October, but some linger as late as November. The last ones are generally seen in Kentucky, Virginia, and the Carolinas during the last week of October, a few are known to winter in South Carolina. From this latitude south to Florida and the Gulf States it is difficult to determine the date when the last birds leave this region for the islands of the West

Indies or via Mexico and points south. Likewise the arrival dates in the spring are confused because of the presence of wintering individuals.

Winter.—The normal winter range of the ovenbird extends from Louisiana eastward through the Gulf States to South Carolina and southward to the West Indies, where it is widely distributed throughout the larger islands, and to the Lesser Antilles, where it has been recorded in many of the islands. It is found throughout the Bahamas. In Mexico its winter range extends from Mazatlán on the Pacific coast, south through Central America to Colombia, South America. It is remarkable that the ovenbird is found as far west in Mexico as Mazatlán as it is a bird of the eastern United States and it is unusual for such birds to move westward, for generally the migration routes extend south or southeastward. Birds wintering in that section of Mexico are those which usually come by the Pacific flyway.

There are records of the ovenbird wintering or attempting to winter as far north as New England. For example J. L. Bagg (1941) found an ovenbird at Montague, Mass., where it regularly visited a feeding shelf, from December 17, 1940, to January 30, 1941, but adds that it may have perished in the subzero night of January 30.

In correspondence received from Alexander Skutch it is stated that the ovenbird is widely distributed on both the Caribbean and Pacific sides of Guatemala and Costa Rica, in midwinter from sea level up to an altitude of 3,000 feet or more. "At this season," Dr. Skutch writes, "it is always alone, and is most often seen walking in its usual deliberate manner over fairly open ground beneath a second-growth thicket, or in a shady plantation. I have not encountered it in the forest. It is typically silent, and I have not heard its song in Central America. It has not been recorded before the first week of October; but it lingers through most of April, and at times well into May."

In Puerto Rico Alexander Wetmore (1916) states: "The oven birds frequent thickets and second-growth forests many times in dry locations. Here they feed on the ground, flying up to low perches when alarmed. They were entirely silent. In coastal regions they are frequently seen in cane fields." In Haiti and the Dominican Republic Wetmore and Swales (1931) state: "The oven-bird is found in thickets and scrubs in both humid and arid sections, where it walks about on the ground in search for food, and though not conspicuous it is not so shy as it is in its northern breeding ground."

In Florida, A. H. Howell (1932) writes: "Never particularly shy, during their winter sojourn the birds often become so tame as to come to a doorstep to pick up crumbs, * * * and once almost walked over my shoes as I sat quietly."

DISTRIBUTION

Range.—Canada to northern South America.

Breeding range.—The ovenbird breeds **north** to northeastern British Columbia (Fort Nelson and Fort St. John); central southern Mackenzie (probably Fort Resolution); central Saskatchewan (Pelican Narrows and Cumberland House); southern Manitoba (Aweme, Fairfield, and Family Lake); central Ontario (Lac Seul, Port Arthur, Amyot, Kapuskasing, and probably Moose Factory); southern Quebec (Mistassini Post, Lake St. John, Godbout, and Anticosti Island); and southern Newfoundland (Tompkins and probably the Avalon Peninsula). **East** to southern Newfoundland (probably the Avalon Peninsula); Prince Edward Island; Nova Scotia (Cape Breton and Baddeck); and the Atlantic Coast States south to northern Georgia (Rising Fawn, Atlanta, and Kirkwood). **South** to northern Georgia (Atlanta); northern Alabama (Florence, Monte Sano, and Anniston); southwestern Tennessee (Fayette County); northwestern Arkansas (Winslow, Magazine Mountain, London, and Clinton); eastern Oklahoma (McCurtain County); and probably eastern Colorado (Holly and Colorado Springs). **West** to Colorado (Colorado Springs, Denver); western South Dakota (Short Pine Hills and Black Hills); southeastern Montana (Miles City, Ekalaka, Long Pine Hills); southern Saskatchewan (Muscow and probably Davidson); and central Alberta (Grand Prairie, Glenevis, and Athabaska); and northeastern British Columbia (Fort Nelson).

Winter range.—The ovenbird winters **north** to northeastern Mexico (Monterrey and Matamoros); southern Louisiana (Avery Island); southern Georgia (Fitzgerald); and southern South Carolina (Mount Pleasant). **East** to South Carolina (Mount Pleasant); north-central Florida (Gainesville and Magnolia); throughout the Greater Antilles (Cuba, Jamaica, Hispaniola, and Puerto Rico); to the Bahamas and Lesser Antilles (Virgin Islands, Anguilla, Antigua, Guadeloupe, Dominica, and Martinique). **South** to the Lesser Antilles (Martinique) and northern Venezuela (Paraguana Peninsula). **West** to northern Venezuela (Paraguana Peninsula); northern Colombia (La Bonda); Panamá (Divala, Gatún, and Darién); Cost Rica; El Salvador; Guatemala (Mazatenango); Quintana Roo (Mujeres and Cozumel Islands); Yucatán (Mérida, Silan, and Chichén-Itzá); central Veracruz (El Conejo and Tres Zapotes); and northeastern Mexico (Matamoros).

Casual records include specimens taken or observed in southwestern Wyoming, southwestern Colorado (Durango), California (Farallon Islands, Glendale, and Lavic), Greenland (Narssag and Nanortalik), and Bermuda.

The species as outlined is divided into three subspecies, or geographic races. The eastern ovenbird (*S. a. aurocapillus*) breeds from northeastern British Columbia to Prince Edward Island and Nova Scotia, south to northern Georgia, and west to Colorado; the Newfoundland ovenbird (*S. a. furvior*), as far as is known, breeds only in the southern two-thirds of Newfoundland; while the gray ovenbird (*S. a. cinereus*) breeds in southern Alberta, southeastern Montana, western South Dakota, and south to central and southeastern Colorado.

Migration.—Late dates of spring departure from the winter home are: Venezuela—Rancho Grande near Maracay, Aragua, April 22. Panamá—Chiriquí, April 15. Costa Rica—Basin of El General, May 14. Nicaragua—Escondido River, May 6. Guatemala—Nebaj, May 3. Nayarit—Madre Island, May 16. Virgin Islands—Kingshill, St. Croix, April 18. Puerto Rico—Mayagüez, April 25. Haiti—Île á Vache, April 30; Île de la Gonâve, May 18. Cuba—Santiago de las Vegas, April 26; average of five years at Habana, April 19. Bahamas—Cay Lobos Light, May 13. Florida—Dry Tortugas Island, May 22; Fort Myers, May 29. Alabama—Decatur, May 15. Georgia—Darien, May 20. Louisiana—University, May 16. Mississippi—Gulfport, May 17.

Early dates of spring arrival are: Florida—Pensacola, April 5. Alabama—Long Island, April 8. Georgia—Athens, April 3. South Carolina—Clemson College, April 13. North Carolina—Raleigh, March 29 (average of 19 years, April 13). Virginia—Lawrenceville, April 6; Rockbridge County, April 20. West Virginia—Bluefield and French Creek, April 22 (average of 16 years at French Creek, April 26). District of Columbia—Washington, April 10 (average of 44 years, April 23). Maryland—Baltimore County, April 9. Delaware—Kent and Sussex Counties, March 27 (average of 18 years, April 9). Pennsylvania—Harrisburg, April 12 (average of 12 years at Philadelphia, April 25). New Jersey—Milltown, April 22. New York—Oneida County, April 13; Bronx, April 15. Connecticut—New Britain, April 24. Rhode Island—Kingston, April 30. Massachusetts—Springfield, April 20. Vermont—St. Johnsbury, April 24. New Hampshire—East Westmoreland, May 2. Maine—Lewiston, April 23; Westbrook, May 1. Quebec—Montreal, April 26. New Brunswick—Bathhurst, May 12. Nova Scotia—Halifax and Wolfville, May 17. Prince Edward Island—North River, May 19. Newfoundland—Tompkins, May 19. Louisiana—Grand Isle, April 4. Mississippi—Gulf coast, March 31. Arkansas—Winslow, April 7. Tennessee—Memphis, March 31; Nashville—April 1 (average of 13 years, April 15). Kentucky—Bowling Green, April 8. Missouri—

St. Louis, April 11. Illinois—Chicago region, April 6 (average May 4). Indiana—Indianapolis, March 31; West Lafayette, April 1. Ohio—Wooster, April 4; average of 19 years at Oberlin, April 27. Michigan—Grand Rapids, April 13; Sault Ste. Marie, April 28. Ontario—London, April 27; Ottawa, May 10 (average of 13 years, May 16). Iowa—Ogden, April 24. Wisconsin—Madison, April 1 (average of 15 years in Dane County, May 1); Superior, April 25. Minnesota—Lanesboro, April 27 (average of 34 years for southern Minnesota, May 7; Duluth, May 4. Texas—Cove, April 1. Oklahoma—Tulsa County, April 6. Kansas—Ottawa, April 21. Nebraska—Peru, April 17. South Dakota—Vermilion, May 5. North Dakota—Wahpeton, May 7. Manitoba—Margaret, April 25. Saskatchewan—Skull Creek, May 15; Fort McMurray, May 28. Colorado—Durango, May 12; Fort Morgan, May 12. Wyoming—Camp Sheridan, May 17. Montana—Miles City, May 18. Alberta—Glenevis, May 11. California—Amboy and Los Olivos, May 13. Alaska—Kenai Peninsula and Nulato, May 30.

Late dates of fall departure are: Alaska—Kenai Peninsula, July 15. Yukon—Lebarge, July 14. British Columbia—Muskwa, July 18. California—Glendale, October 25. Montana—Hell Gate, August 26. Colorado—Mount Morrison, August 28. New Mexico—Dona Ana County, October 13. Alberta—Glenevis, September 14. Saskatchewan—Regina, September 14. Manitoba—Aweme, September 28 (average September 15); Winnipeg, October 2. North Dakota—Cass County, September 26 (average September 20); Fargo, October 4. South Dakota—Faulkton, October 5. Texas—Cove, November 19. Minnesota—Lanesboro and Minneapolis, October 16 (average of 9 years in southern Minnesota, September 23). Wisconsin—Superior, October 23. Iowa—Wall Lake, October 26. Ontario—Ottawa, October 15. Michigan—Grand Rapids, October 18. Ohio—Jerusalem Township, November 9; central Ohio, October 16 (average October 2). Indiana—Richmond, October 20. Illinois—Chicago region, October 19 (average October 2); Urbana, October 24. Missouri—Noel, November 1. Kentucky—Danville, October 14. Tennessee—Memphis and Nashville, October 15. Arkansas—Amity, October 10. Mississippi—Gulf coast, November 1. Louisiana—St. Francisville, October 17. Greenland—Narssaq (near Godthaab), October 15. Newfoundland—Cape Anguille, October 3. New Brunswick—Grand Manan, September 16. Quebec—Montreal, September 25. Maine—South Portland, October 22. New Hampshire—Water Village, October 28. Vermont—Rutland, October 11. Massachusetts—Boston, November 14; Lincoln, December 12. Connecticut—

West Hartford, November 1. New York—New York City, November 23. New Jersey—South Mountain Reservation, November 24; Summit, December 18. Pennsylvania—Berwyn, October 30. Maryland—Patuxent Wildlife Research Refuge, October 19. District of Columbia—Washington, November 13 (average of 23 years, October 3). West Virginia—Bluefield, October 15. Virginia—Lexington, October 15. North Carolina—Raleigh, October 23. South Carolina—Chester, October 29. Georgia—Lybee Light, Savannah, November 11. Alabama—Greensboro, October 19. Florida—Clewiston, November 8. Bahamas—Cay Lobos Light, November 22.

Early dates of fall arrival are: Texas—Rockport, August 13. Ohio—Buckeye Lake, July 30 (average, August 15). Louisiana—Rigolets, August 9. Mississippi—Gulf coast, August 25. Massachusetts—Marblehead, August 14. North Carolina—Raleigh, August 5. South Carolina—Summerton, July 7; Chester, August 7. Georgia—Athens, August 2. Alabama—Leighton, August 10. Florida—Pensacola, August 10; Dry Tortugas Island, August 16. Cuba—Santiago de las Vegas, August 26. Puerto Rico, October 3. Antigua, October 9. Honduras—Tela, October 9. Costa Rica—San Miguel de Desamparados, November 1. Colombia—Bond, October 4. Venezuela—Paraguana Peninsula, October 22.

Egg dates.—Massachusetts: 66 records, May 17 to July 1; 37 records, May 30 to June 6, indicating the height of the season.

Michigan: 12 records, May 16 to July 26; 6 records, May 27 to June 14.

Quebec: 17 records, May 27 to June 21; 10 records, June 3 to 10.

Pennsylvania: 14 records, May 15 to June 3; 10 records, May 25 to 31 (Harris).

SEIURUS AUROCAPILLUS FURVIOR Batchelder

NEWFOUNDLAND OVENBIRD

HABITS

Based on a series of 19 specimens collected in Newfoundland, Charles F. Batchelder (1918) gave the above name to the ovenbirds of that region. He describes the subspecies as follows: "Similar to *Seiurus aurocapillus*, but plumage in general deeper-colored or darker. Tawny of crown browner, less yellowish—'amber brown', instead of the 'ochraceous orange' of *aurocapillus;* black of sides of crown more extensive and slightly more intense; back, from nape to upper tail coverts, and including scapulars, duskier green; dark markings of breast and sides heavier and blacker; brown of flanks deeper."

SEIURUS AUROCAPILLUS CINEREUS A. H. Miller

GRAY OVENBIRD

HABITS

Dr. Alden H. Miller (1942) has given the above name to the ovenbirds of the eastern slope of the Rocky Mountains. He describes the race as follows: "Compared with *Seiurus aurocapillus aurocapillus* of the eastern United States and Mississippi Valley, back, rump and lateral webs of rectrices grayer and paler, less intense olive-green, the feather tips at least approaching grayish olive; green almost lacking in the tails of some individuals; auriculars and side of neck less tawny."

Of its geographical distribution, he says that it breeds "along the lower eastern slopes of the Rocky Mountains and adajacent plains from the Yellowstone River in Montana south to the Arkansas River in Colorado. Suitable habitats include streamside woodlands and yellow pine forests." It "is known as a migrant from Sinaloa and the Tres Marías Islands, Mexico, where it possibly winters."

SEIURUS NOVEBORACENSIS NOVEBORACENSIS (Gmelin)

NORTHERN SMALL-BILLED WATERTHRUSH

PLATE 59

HABITS

This brilliant songster, the northern waterthrush, is known to most of us in the United States as a spring and fall migrant. It often appears in our yards or gardens walking gracefully about on the lawn or under the shrubbery, but we are much more likely to find it in the thickets along the edges of the swamps or ponds, on the banks of streams, or walking daintily over the muddy shores of some shaded woodland pool. At such times it seems rather familiar and is easily approached, but on its more northern breeding grounds it is more secretive and must be looked for in the more secluded nooks in cool bogs, along the mountain streams, or about the shores of northern lakes in the Canadian Zone. There its loud and charming song will reveal its presence and tempt the listener to invade its hidden haunts.

The breeding range of the northern waterthrush includes northern New England and much of eastern Canada, but extends southward in the mountains to Pennsylvania and Virginia. It breeds locally and rarely in southern New England and New York. I once found it breeding in Rhode Island in an extensive maple swamp where cool, clear water was flowing slowly among the stumps and upturned roots of fallen trees; there, within a radius of 100 yards, we found nests of this and the Louisiana waterthrush and the winter wren, a curious mingling of northern and southern species; the musical voices of these three famous singers produced a concert that can better be imagined than described.

Todd (1940) says that at higher altitudes in western Pennsylvania, it "is sometimes found along swift mountain streams, but as a general rule it favors isolated pools of standing water in the woods—the kind of habitat that does not attract the other species at all. Rhododendron swamps are favorite haunts." Prof. Maurice Brooks (1940) says that, in the central Allegheny Mountain region, "this species, found along some of the mountain streams and in swamps at high altitudes, reaches its known southern breeding limits at Cranberry Glades. * * * It is confined to the Canadian and upper Alleghenian zones, nesting as low as 2,500 feet at Cranesville swamp in West Virginia and Maryland. * * * These warblers show a preference for streams that are lined with spruce, hemlock, or rhododendron, or a combination of these, but they may occassionally be found in northern hardwood forest."

Spring.—From its wide winter range in the West Indies and in northern South America this species apparently migrates northward over two widely separated routes, both east and west of the Gulf of Mexico, but as most of the migration records do not distinguish between the two races and are seldom based on collected specimens, it is impossible to define the routes followed by the two subspecies. It is reasonably certain, however, that the birds that winter in the West Indies and migrate northward along the Atlantic Coast States are the eastern form, although it is possible that the birds of this race that winter in British Guiana may migrate through the Antilles to Florida and northward. We would naturally expect to find that most of the birds that take the western route through Central America, Mexico, and Texas, are of the western race, *notabilis;* but typical *noveboracensis* has been taken on migration along the coast of Mexico. I have seen waterthrushes migrating along the coast of Texas, but I have taken no specimens. Birds that take the western route apparently migrate northward through the Mississippi Valley.

Nesting.—My friend Harry S. Hathaway, who had reported (1906) the nesting of the northern waterthrush in Rhode Island, showed me in 1908 what is probably the most southeastern locality in New England where this species breeds, a corner of Kingston swamp, the main portion of which was originally a cedar swamp. Most of the cedar had been cut off and was then replaced by a heavy forest of maples, large swamp white oaks, red oaks, beeches, gray and yellow birches, a few lone pines, fine holly trees, and dense patches of rhododendron. It was a cool and shady retreat, the dense foliage of the large trees shut out the sunlight, and the atmosphere was cooled by a steady flow of clear, cold spring water, in some places nearly knee deep. It was a locality well suited for such northern birds as the winter wren and this waterthrush. The nest of the latter was neatly hidden in a little cavity in a moss-covered stump prettily overgrown with ferns, the hanging dead fronds of which partially concealed the nest; it was placed only 14 inches above the water of a small pool at the base of the stump. The nest, an attractive structure, was made mainly of sphagnum moss and skeletonized leaves and was lined with green sphagnum and the red fruiting stalks of mosses. It held four fresh eggs on May 24.

I found two nests of the northern waterthrush on the heavily wooded shores of Asquam Lake, N. H., in 1926. The first nest was under an overhanging bank at the very edge of the rocky shore of the lake; it was sunken into the soil of the bank in a sheltered hollow, and contained four fresh eggs on June 16. The nest was largely made of green mosses, mixed with a few twigs, many pine needles, a few fine strips of inner bark, and some fine, black rootlets; it was lined with very fine grasses and a little cow hair. The other nest was in a similar location, but was far in under the roots of a large dead stub overhangin the bank on the shore of the lake; it was not quite finished on June 18.

F. H. Kennard mentions in his notes a nest found near Lancaster, N. H., on June 14, 1910, that was placed in the moss on the side of a moss-covered stump in a dark, swampy place. The nest was in plain sight beneath the arch formed by two roots of the stump. T. E. McMullen has sent me the data for eight nests found in the Pocono Mountains of Pennsylvania, all found in the upturned roots of fallen trees in swamps or along streams.

Eggs.—The northern waterthrush lays either 4 or 5 eggs to a set, apparently about evenly divided, occasionally only 3 and rarely 6. These are ovate to short ovate and have little or no gloss. The ground color is creamy white or buffy white, or rarely "pale, ochraceous-buff. The eggs are speckled, spotted, and blotched with "auburn," "argus brown," "Brussels brown," or "cinnamon-brown," with underlying spots of "light purplish gray" or "fuscous." They may be finely and sparsely speckled, or boldly blotched, but in general are more heavily marked than those of the ovenbird. They may also be decorated with small scrawls or cloudings of "wood brown." Occasionally this clouding almost entirely obscures the ground color. All types of markings are concentrated at the large end. In looking over a large series of these eggs, the gray spots seem rather less pronounced than on the eggs of the Lousiana waterthrush. The measurements of 50 eggs average 19.1 by 14.6 millimeters; the eggs showing the four extremes measures **20.8** by 15.0, 19.3 by **16.0**, and **17.8** by **13.7** millimeters (Harris).

Young.—Nothing seems to be known about the incubation, or about the care and development of the young.

Plumages.—Dr. Dwight (1900) calls the natal down deep olive-brown, and describes the juvenal plumage of the northern waterthrush as "above, deep olive-brown with cinnamon edgings. Wings and tail darker, the coverts tipped with pale cinnamon. Below, primrose-yellow heavily streaked on the chin and less heavily on the throat, breast and sides with deep olive or clove-brown. Indistinct superciliary line and orbital ring buff; transocular stripe dusky."

The first winter plumage is acquired by a partial postjuvenal molt in July, which involves the contour plumage and the wing coverts, but not the rest of the wings or the tail. Young and old are now practically indistinguishable. The sexes are alike in all plumages. Dr. Dwight describes this plumage as "above, yellowish olive-brown including wing coverts, without edgings. Below, straw-yellow, palest on the crissum, the flanks washed with olive-brown, spotted on the chin and streaked, except on the mid-abdomen and crissum, with black veiled by overlapping whitish edgings. Superciliary stripe and orbital ring pale ochraceous-buff; transocular streak deep olive-brown; auriculars dusky.

"First nuptial plumage acquired by marked wear, birds becoming browner above and paler below, the veiling lost. It is possible there is a very limited growth of new feathers about the head." Year-old birds can usually be recognized by the paler and somewhat worn wings and tails.

Adults have a complete postnuptial molt in July. The adult winter plumage is like that of the first winter, but the streakings below are rather broader and the wings and tail are darker. Subsequent spring plumages are produced by wear, as in the young bird.

Food.—Forbush (1929) writes: "The food of the Water-Thrush consists more or less of aquatic insects, beetles and their larvae, and moths. It picks up dead and soggy leaves from crevices in the rocks and throws them aside, thus uncovering lurking creatures on which it feeds. According to Dr. Elliott Coues tiny molluscs and crustaceans are eaten, and Arthur T. Wayne took one that had eaten a few small minnows. Dr. B. H. Warren names small worms as one consituent of its food, and it also eats quantities of mosquitoes."

Dr. Wetmore (1916) reports on the contents of four stomachs of this species, including both races, collected in Puerto Rico, as follows:

"Fly pupae and a few adults were present in three stomachs and amount to 43 per cent of the total. Ants (24 per cent), of which one bird had eaten 40, were found in three stomachs. Water scavenger beetles were found in two instances and a hister beetle (*Hister* sp.) once. In one stomach were five water boatmen (*Plea* sp.) and another aquatic bug, and two contained the remains of small crabs (in one case of *Uca*). In single stomachs were found the jaw of an orthopteran, a lantern fly, and a bone from the head of a tiny fish."

Stuart T. Danforth (1925) reports on the 95 percent of animal food in four stomachs, also from Puerto Rico, "3 damselflies, 10 per cent; 20 large fleabeetles (*Haltica jamaicensis*), 19 percent; 2 fleabeetles (*Systena basalis*), 1.3 per cent; Carabid beetles (*Stenous* sp.), 26.2 per cent; pupa of a Sesban weevil (*Tyloderma* sp.), 1.2 per cent; other Colepterous fragments, 5 per cent; 2 Noctuid caterpillars, 5 per cent; 1 Syrphid fly (*Volucella obesa*), 2 per cent; 3 caseworms (*Tincola uterella*), 6.1 per cent; 1 slug, 2.5 per cent." He also reported a few seeds.

Behavior.—Forbush (1929) describes the behavior of the waterthrush, much better than I can, in the following words: "Though not really a thrush, the Water-Thrush is well named. It is a large wood warbler disguised as a thrush and exhibiting an extreme fondness for water.

"Like the Oven-bird it walks, and seems fond of walking on a log, but prefers to pass down a slanting log, the lower end of which enters the water. It is unlike the Oven-bird, however, in its almost continuous teetering of the body and wagging of the tail, which it seems to move up and down almost as unconsciously and regularly as it draws the breath of life; this action is accompanied by a springy motion of the legs."

Dr. Coues (1878) aptly refers to the timidity and retiring habits of the waterthrush during the nesting season and adds:

> But this is only when he feels the cares and full responsibilities of home and family. Later in the season, when these things are off his mind, he is quite another fellow, who will meet you more than half-way should you chance to find him then, with a wondering, perhaps, yet with a confident and quite familiar, air of easy unconcern. Anywhere by the water's edge—in the *débris* of the wide-stretched river-bottom, in the flowery tangle of the brook, around the margins of the little pools that dot the surface where tall oaks and hickories make pleasant shade—there rambles the Water-Thrush. Watch him now, and see how prettily he walks, rustling among the fallen leaves where he threads his way like a mouse, or wading even up to his knees in the shallow miniature lakes, like a Sandpiper by the sea-shore, all intent in quest of the aquatic insects, worms, and tiny molluscs and crustaceans that form his varied food. But as he rambles on in this gliding course, the mincing steps are constantly arrested, and the dainty stroller poises in a curious way to see-saw on his legs, quite like a Titlark or a Spotted Sandpiper.

We always think of the waterthrush as living on or near the ground and in the immediate vicinity of water, in such places as those mentioned, but there are exceptions to the rule, especially during migrations. Wendell Taber tells me that he heard two of them singing, and saw one of them "sitting near the top of a birch tree which rose out of the swamp and which towered above all other trees about except balsams." He estimated that the bird was about 35 feet above the ground. On another occasion, he saw one in a hemlock grove, a long distance from any water. The bird was very tame, and was "walking around, bobbing, on hemlock limbs."

Mr. Brewster (1938) gives the following account of the behavior of a bird about a nest he was photographing:

> The female was very nervous and fussy, chirping and calling up her mate the first thing. She would not go on the nest when the camera was near it but kept running rapidly about around the bank and the camera, examining the latter as well as the bulb of my rubber tube which lay several yards off with evident distrust. When started from the nest she would regularly run six or eight yards, crouching close to the ground and moving with a slow gliding motion, spreading her tail and half spreading and quivering her wings, sometimes turning back and gliding past me or just under the nest, making no sound nor tilting while behaving thus, but presently flying up to some branch or root to tilt and chirp with her mate.

Again, he writes: "As I was sitting in my canoe this afternoon in a sheltered cove one appeared on the shore within three yards of me. By degrees it approached even nearer running about over some driftwood, now and then pausing to look at me intently with its large dark eyes. Even when I moved abruptly it showed no fear of me."

Voice.—Aretas A. Saunders (MS.) describes the song as follows: "The song of the northern waterthrush is a series of rather short, staccato notes, either all equal in time or accelerating toward the end. The number of notes in my 30 records varies from 6 to 15 and averages about 10. The song is loud, and the notes are of sweet, musical quality. They contain marked consonant sounds, with explosive, and liquid, single notes sounding like *tleep*, *tlip*, or *tlap*.

"The pitch of the song varies from C''' to D'''', one tone more than an octave. Single songs have a range of from one to three and a half tones, the majority, 16 records, ranging two and a half tones. The general trend of change in pitch, in all songs, is downward. In all but 4 of my records the last note is the lowest in pitch. In all but 6 the first note is on the highest pitch of the song. In 10 of the records, however, the downward trend of the pitch is broken by a single high note, sometimes as high as the first note, near the end of the song, and most frequently the next to the last note.

"Songs vary from 1⅘ to 2⅗ seconds. In a majority of the songs the first notes are slow, and the remaining notes become gradually more rapid, but 13 of my records show no change in time, the notes all being of equal length.

"This song may be heard commonly from migrating birds, and, on the breeding grounds, continues until about the middle of July. I have little data on the summer song, however, and cannot give average dates for the time of cessation."

Francis H. Allen tells me that he has recorded the song as "*wheet wheet chip chip chip wheedleyou*, and as *wheet wheet chip chip chip chip chip'-ū*, the final *ū* rather faint. A call or alarm note is a sharp, metallic or perhaps 'stony' *chip*, thinner than that of the ovenbird, but carrying well." In 1912, in Newfoundland, I recorded the song as *chip chip chip chip chitter chitterew.*

Gerald Thayer wrote to Dr. Chapman (1907):

> At its best the song of this species is not quite so fine, perhaps, as that of *Seiurus motacilla*—it is very different, and has a rare grace and vigor of its own. Like the Oven-bird the Northern Water-Thrush makes up for a great general regularity of singing by an occasional wide lapse into variation. Its flight-song, a performance relatively far less common than the Oven-bird's (?), seems to be nearly changeless. It is like the common perch song, but quicker and longer, and "framed" in a hurried jumble of half-call-half-song notes;—the whole delivered as the bird dashes horizontally through or barely above the woods. Most notable among the few important variations of its perch-song I have heard was a long, liquid strain seemingly made up of at least three united repetitions of the regular utterances, going unusually fast, in a thinner tone, and intersprinkled with sharp notes of "chippering," unlike the common call-notes. The typical perch-song itself is hard to describe in words. A ringing, bubbling warble, swift and emphatic, made up of two parts, barely divided, the second lower-toned and diminuendo.

Dr. Sutton (1928) recognizes the song as expressed by the human words, "*Hurry, hurry, hurry, pretty, pretty, pretty.*"

Albert R. Brand (1938) gives for the song of this species a range of from 2,000 to 3,850 vibrations per second, with an approximate mean of 2,925, the lowest frequency, or the lowest pitch, that he recorded in any of the other wood warblers, except the yellow-breasted chat.

Field marks.—The bird with which the northern waterthrush is most likely to be confused is its congener, the Louisiana waterthrush; the former has a buffy line over the eye and sulphur-yellow under parts, streaked with black almost up to the chin; the latter has a more conspicuous pure white stripe over the eye, a much whiter throat, and white underparts, streaked less conspicuously with olive-brown; the latter also has a larger bill. The ovenbird has no stripe over the eye.

Enemies.—Dr. Friedmann (1929) says that the waterthrush is "rarely victimized" by the cowbird; probably the latter has difficulty in finding its nest, as only four observers have reported cases of victimization.

Harold S. Peters (1936) reports one louse, *Menacanthus* sp., and two bird-flies, *Ornithoica confluenta* Say and *Ornithomyia anchineuria* Speiser, as external parasites on the northern waterthrush.

Fall.—The northern waterthrush starts on its fall migration before the end of July and passes through the Atlantic Coast States mainly in August; it has been recorded in Costa Rica as early as August 12, and generally reaches its winter home in September. P. H. Gosse (1847) records its arrival in Jamaica as early as August 5.

Waterthrushes are sometimes very abundant on the fall migrations and may be found almost anywhere, even about buildings. Taverner and Swales (1908) write of the migration at Point Pelee, Ontario: "During the height of their abundance they were the most conspicuous bird on the Point, and were seen in all kinds of places, and at all times. They were in the low, damp spots in the woods, in the high walnut timber, and in the red cedar thickets. They were common everywhere. We found them in the last outlying brush pile near the end of the final sand spit, and in patches of weeds and cotton woods along the eastern sand dune. * * * It was no uncommon sight to have four or five in the same line of vision, besides others that could be heard and not seen."

Winter.—A few waterthrushes may spend the winter in Florida, but most of them pass on to the Bahamas and the West Indies, or to Central America and northern South America. Savile G. Reid (1884) lists this species as "one of the commonest but most interesting of autumnal visitors" in Bermuda. "It appears regularly early in October and a few remain all winter." It appears to be a regular winter resident in the Bahamas. Dr. Wetmore (1916) records it as "a fairly common winter visitant in the coastal region of Puerto Rico. * * * These water-thrushes occur only in the mangroves of the coastal region, where they are found about bays and lagoons feeding on the ground, and though their sharp call notes are heard repeatedly, the birds themselves are usually hidden. * * * In April they were singing as clearly as in the North." Dr. Barbour (1923) says that, in Cuba, it is "a not uncommon winter visitor. Found about lakes, ditches and river banks, and in the mangroves along the seashore."

In El Salvador, Dickey and van Rossem (1938) record it as "fairly common in fall, winter, and spring throughout the lowlands and foothills. Dates of arrival and departure are August 31 and April 29. * * * While in winter quarters water-thrushes seem always to be solitary. They were usually to be observed walking daintily about in wet or boggy places, such as swamp holes in the forest or at the water's edge along streams and ponds."

Dr. Skutch contributes the following notes: "All three races of waterthrush occur as migrants in Central America. Griscom regards the western race as the more abundant; while Carriker considered typical *noveboracensis* as the prevalent race in Costa Rica.

"Throughout Central America, the northern waterthrush (including its western representatives, Grinnell's and McCabe's waterthrushes), is seen far more often than the Louisiana waterthrush. It occurs as an abundant spring and fall transient, and as a not very abundant winter resident. As a bird of passage, it is found in both spring and fall on both sides of the Cordillera, while in the highlands I have met it as high as 10,600 feet. As a winter resident, it is most abundant in the Caribbean lowlands, but has been recorded in midwinter in the Pacific lowlands. It arrives in Central America in August or September, and remains until April or May, late stragglers sometimes delaying until May 30.

"Like its relatives, the Louisiana waterthrush and the ovenbird, the northern waterthrush leads a solitary existence in its winter home. Most often seen foraging along the shores of streams and lagoons, but it is by no means confined to the immediate vicinity of water, for in the Central American lowlands it will occasionally be found walking sedately through a banana plantation or an orchard where the ground is moist and not too encumbered with weeds, or on the bare ground about houses where all is quiet, or even over shady lawns, flicking fallen leaves aside with its bill. But although it will at times venture so close to the habitations of man, it is not for that reason at ease in his presence, and is always ready to fly when the inmates of the dwelling show themselves. On the Island of Jamaica, in December, 1930, I found northern waterthrushes abundant in the swamps of black mangrove (*Avicennia nitida*) along the south coast, where the naked muddy ground was covered with shallow water. Doubtless they haunt similar situations in Central America.

"Early dates of fall arrival in Central America are: Guatemala—Sierra Cuchumatanes, 10,600 feet, September 15, 1934. Honduras—Tela, October 5, 1930. Costa Rica—San José (Cherrie), September 14; Escazú (Carriker), August 13, 1902; Basin of El General, October 18, 1936.

"Late dates of spring departure from Central America are: Panamá—Barro Colorado Island, Canal Zone, April 12, 1935. Costa Rica—El Pozo de Térraba (Underwood), April 8, 1906; Basin of El General, April 23, 1936, April 27, 1939, April 17, 1940, and April 11, 1942; San José (Cherrie), May 21 and May 30. Honduras—Tela, May 9, 1930. Guatemala—Sierra de Tecpán, 8,500 feet, April 27, 1933; Motagua Valley, near Los Amates, May 18, 1932; Finca Sepacuité (Griscom), May 22."

DISTRIBUTION

Range.—North America, the West Indies, and northern South America.

Breeding range.—The waterthrush breeds **north** to north-central Alaska (valleys of the Kobuk and Yukon Rivers); northern Yukon

(La Pierre House); northwestern and central southern Mackenzie (Aklavik, Fort McPherson, Fort Good Hope, Fort Norman, Fort Simpson, Fort Rae, Fort Resolution, and Hill Island Lake); northeastern Saskatchewan (Cochrane River); northern Manitoba (north end of Lake DuBrochet, Churchill, and York Factory); northern Ontario (Seven House, mouth of the Attawapiskat River, and Moose Factory); north-central Quebec (Fort George, inland from Richmond Gulf, Lake Albanel, and probably Fort Chimo); Labrador (Davis Inlet, Cartwright, St. Peter's Bay and probably Grand Falls); and Newfoundland (Hare Bay, Canada Bay, Fogo Island, Gander, and St. John's). **East** to Newfoundland (St. John's); Nova Scotia (Bridgetown, Halifax, and probably Sable Island); central Massachusetts (Lenox, Huntington, Amherst, Ware, Boston, rarely Springfield, and Taunton); rarely in Rhode Island (Washington County and Kingston); New York (Lime Lake, Naples, Potter, Canandaigua, and Oswego); northwestern New Jersey (High Point, Newfoundland Lake, and Sparta); Pennsylvania (Eagle Rock, Warren, Hollidaysburg, Williamsport, and the Pocono Mountains); West Virginia (Bluefields, Pendleton County, and Shepherd Grade); western Virginia (Salem); and western North Carolina (Buncombe County). **South** to North Carolina (Buncombe County); Ohio (Cleveland, Austinburg, Trumbull County, and Pymatuning Swamp); northern Michigan (Brown Lake, Huron Mountains, Blaney Park, and Less Chenneaux Island); rarely Wisconsin (Dunn County, Unity, and Shiocton); northeastern Minnesota (Gull Lake, Otter Lake, and Duluth); central North Dakota (Turtle Mountains); western Montana (Fortine, Bitterroot Valley, Florence, Gallatin County, and Great Falls); northern Idaho (Coeur d'Alene and St. Maries); central Saskatchewan (Buffalo River, Carlton House, and Cumberland House); southern Alberta (Grand Prairie, Jasper Park, and Vermillion Lakes); and British Columbia (Okanagan Landing). **West** to British Columbia (Okanagan Landing, Lac la Hache, Frazer Lake, Glenora, Doch-da-on Creek, and Fort Nelson); and Alaska (Goodnews Bay, Seldovia, Tustamena Lake, Tanana Crossing, and Kobuk River Valley).

Winter range.—The waterthrush winters **north** to southern Baja California (Magdalena Bay, La Paz, San Pedro, and San José del Cabo); southern Mexico (Acapulco, Tlalpan, Guerrero, Jalapa, San Andres, Tuxtla, and Chinchorro Bank); Yucatán Peninsula (Mujeres Island); Cuba (Habana and Cienfuegos); the Bahamas (New Providence, San Salvador, and Great Inagua); Bermuda; Haiti (Tortue Island, Caracol, and Etang de Miragoâne); Dominican Republic (Monte Cristi and San Juan); and Puerto Rico (Mona Island, Mameyes, and Culebra Island). **East** to Puerto Rico (Culebra Island); throughout the Lesser Antilles (Virgin Islands, Antuilla, Barbuda, Antigua, Guadeloupe, San Lucia, the Grenadines, Tobago, and Trinidad); and French Guiana (Cayenne). **South** to French Guiana (Cayenne); British Guiana; and Ecuador (Esmeraldas). **West** to Ecuador (Esmeraldas); through Central America; Mexico (Tulancingo and Metlaltoyuca); to southern Baja California (Magdalena Bay).

Casual records include specimens taken or observed in Greenland, Texas, Michigan, Louisiana, and Mississippi.

The species as outlined is divided into three subspecies or geographic races. The northern waterthrush (*S. n. noveboracensis*) breeds in the eastern part of the range from Newfoundland to North Carolina; Grinnell's waterthrush (*S. n. notabilis*) takes up the greater part of the range from Alaska to southwestern Labrador and south through north-central Quebec, northern Michigan, northeastern Ohio, and west; while McCabe's waterthrush (*S. n. limnaeus*) breeds in central British Columbia.

Migration.—Late dates of spring departure are: Venezuela—Rancho Grande near Maracay, Aragua, April 22. Colombia—Santa Marta region, April 30. Panamá—San Miguel Island, April 29. Costa Rica—San José, May 21. Nicaragua—southeastern, May 5. Honduras—near Tela, May 9. Guatemala—Uaxactún, May 7. Vera Cruz—Presidio, May 21. Baja California—Puerto Balandra, May 18. Virgin Islands—St. Croix, May 5. Puerto Rico—Fortuna, May 10. Haiti—Île à Vache, May 6. Cuba—Habana, May 20.. The Bahamas—Cay Lobos Light, May 17.

Early dates of spring arrival are: The Bahamas—Cay Lobos Light, April 11. Florida—Miami, March 15; Pensacola, March 16. Alabama—Sylacauga, April 16. Georgia—Macon, March 15. South Carolina—Mount Pleasant, March 24. North Carolina—Raleigh, April 4 (average of 15 years, April 27). Virginia—Rockbridge County, April 16. West Virginia—Bluefield, April 22. District of Columbia—Washington, April 16 (average of 36 years, April 27). Maryland—Plummers Island, April 18. Pennsylvania—Sandy Lake, Mercer County, April 22; State College, April 24 (average, April 26). New Jersey—Fort Lee, April 21. New York—Cold Spring Harbor, Long Island, April 14; Ithaca, April 23. Connecticut—Portland, April 27. Rhode Island—Kingston, April 21. Massachusetts—Nahant, April 22. Vermont—Rutland, April 26. New Hampshire—Hancock, April 29. Maine—Phillips, April 28. Quebec—Montreal, April 30. New Brunswick—Scotch Lake, May 4. Nova Scotia—Wolfville, May 3. Prince Edward Island—Mount Herbert, May 13. Newfoundland—Stephenville Crossing, May 22. Louisiana—New Orleans, April 7. Mississippi—Deer Island, April 19. Tennessee—

Memphis, April 19. Kentucky—Bowling Green, April 27. Missouri—St. Charles, April 21. Illinois—Chicago region, April 7 (average, April 20). Indiana—Richmond, April 25. Ohio—Oberlin, April 16; central Ohio, April 15 (average, April 28). Michigan—Ann Arbor and Detroit, April 27. Ontario—London, April 23; Ottawa, May 8. Iowa—Ames and Hudson, April 30. Wisconsin—Sheboygan, April 25; Madison, April 26. Minnesota—Minneapolis, April 22 (average of 32 years for southern Minnesota, May 3). Texas—Atascosa County, March 28. Kansas—Lake Quivira, April 25. Nebraska—Omaha, April 24. South Dakota—Sioux Falls, April 30. North Dakota—Argusville, April 30 (average, May 16). Manitoba—Aweme, May 4 (average, May 14). Saskatchewan—Indian Head and Lake Johnston, May 11. Mackenzie—Fort Simpson, May 14; Mackenzie Delta, May 31. New Mexico—Silver City, May 6. Arizona—Tucson, April 26. Colorado—Denver, May 12. Utah—Uinta Basin, May 8. Wyoming—Lake Como and Torrington, May 10. Idaho—Pocatello, May 13. Montana—Fortine, May 12. Alberta—Glenevis, May 12. California—Altadena, May 15 (only spring record). British Columbia—Okanagan Landing, May 2; Nulki Lake, May 26. Yukon—Forty Mile, May 20. Alaska—head of North Fork of Kuskokwim River, May 16; Bethel, May 27.

Late dates of fall departure are: Alaska—Nunivak Island, August 22; St. Michael, August 25. Yukon—Dawson, August 29; Macmillan Pass, September 4. British Columbia—Mushwa, September 8; Arrow Lakes, September 24. Washington—Prescott, September 11. California—Rodeo Lagoon, Marin County, October 18. Alberta—Glenevis, September 1. Montana—Fort Keogh, September 12. Wyoming—Laramie, September 13. Utah—Zion National Park, September 22. Colorado—Clear Creek, September 3. Arizona—Phoenix, September 16. New Mexico—Glenrio, October 21. Mackenzie—Mackenzie Delta August 15; MacTavish Bay, August 22. Saskatchewan—Redberry, September 1. Manitoba—Treesbank, October 13. North Dakota—Lower Souris Refuge, Upham, October 4; Cass County, September 23 (average, September 18). South Dakota—Faulkton, September 30. Nebraska—Minden, October 19. Texas—Anahuac, October 18; Glenrio, Deaf Smith County, October 21. Minnesota—Minneapolis, October 15 (average of 17 years for southern Minnesota, September 24). Wisconsin—Madison, October 19. Iowa—National, October 15. Ontario—Ottawa, September 17; Sundridge, October 18. Michigan—Sault Ste. Marie, October 13. Ohio—Ashtabula County, October 18; Buckeye Lake, October 13 (average, October 1). Indiana—Lake and Porter Counties, October 12. Illinois—Chicago region, October 21. Missouri—St. Louis, October 17. Kentucky—Bowling Green, October 8. Tennessee—Memphis, October 6. Louisiana—Baton Rouge region, October 24. Mississippi—Gulf coast, October 24. Newfoundland—Tompkins, September 18. Nova Scotia—Bridgetown, September 30. New Brunswick—Grand Manan, September 16. Quebec—Quebec, September 23. Maine—Winthrop, October 22. New Hampshire—Monroe, September 20. Vermont—Woodstock, September 20. Massachusetts—Worcester, October 16; Swampscott, November 17. Rhode Island—Providence, October 8. Connecticut—West Hartford, October 24. New York—Schenectady, October 25; Rhinebeck, November 16; Brooklyn, November 30. New Jersey—Union County, October 23 (average of 12 years, October 8). Pennsylvania—Renovo, October 15. Maryland—Cambridge, October 22; Solomons, December 12. District of Columbia—Washington, October 16 (average of 15 years, September 25). West Virginia—Bluefield, October 11. Virginia—Rockbridge County, October 27. North Carolina—Louisburg, October 13; Raleigh, October 12 (average of 9 years, September 29). South Carolina—Mount Pleasant, October 22. Georgia—Augusta, October 22. Alabama—Brewton, October 8. Florida—Pensacola, October 22; Fort Myers, October 24. Bahamas—Cay Lobos Light, October 30.

Early dates of fall arrival are: Yukon—Sheldon Lake, Canol Road, August 7. California—Marin County, August 13; Cactus Flat, San Bernardino County, August 16. Montana—Chief Mountain Lake, and west of Sweet Grass Hills, and Billings, August 12. Wyoming—Fort Steele, Carbon County, August 9. Utah—Uinta Basin, August 11. Colorado—Estes Park, July 16. Arizona—Mormon Lake, August 17; Camp Verde, August 27. New Mexico—Glenrio, August 25. Manitoba—Treesbank, August 21. North Dakota—Cass County, August 13 (average August 16). South Dakota—Faulkton, August 10. Kansas—Doniphan County, August 23. Oklahoma—Fort Sill, August 29. Texas—Mission, August 5. Minnesota—Minneapolis, August 14 (average of 11 years for southern Minnesota, August 27). Wisconsin—Beloit, August 14. Iowa—National, August 14. Ontario—Sundridge, July 13. Michigan—McMillan, August 6. Ohio—Lucas County, July 23 (1932); Buckeye Lake, August 14 (average August 24). Indiana—Whiting, August 10. Illinois—Chicago region, August 1 (average August 20). Missouri—La Grange, August 14. Tennessee—Quebec and Nashville, August 21. Louisiana—Baton Rouge region, August 15. Mississippi—Biloxi, August 11. New Brunswick—Kent Island, July 31. Maine—Seguin Island Light, August 5. Massachusetts—Belmont, August 1. Rhode Island—Block Island, July 29. Connecticut—Hartford, July 17. New York—Elmhurst, Long Island, July 20. New Jersey—Cape May, July 23. Pennsylvania—Berks County, August 7. Maryland—Kensington, July 21. District of Columbia, Washington, July 28 (average of 13 years, August 12). Virginia—Fort Belvoir (10 miles south of Alexandria), August 16. North Carolina—Raleigh, July 21 (average of 7 years, August 3). South Carolina—Clarendon County, July 7. Georgia—Athens, August 18. Alabama—Greensboro, August 25. Florida—Pensacola, August 19, Boca Chica Key, August 26. Cuba—Cienfuegos, July 8 and August 20; Batabano, Habana, August 20. Jamaica—August 5. Puerto Rico—Mona Island, August 18. Barbuda—August 25. Senora—Bernardina River, September 4. Guatemala—Sierra Cuchumatanes, September 15. Nicaragua—near Bluefields, September 19. Costa Rica—base of Volcán Turialba, August 12. El Salvador—Lake Olomega, August 31. Panamá—east coast of Panamá, September 18. Colombia—Santa Marta region, September 8. Venezuela—Tucacas, Estado Falcón, October 19. French Guiana—Cayenne, October 14.

Egg dates.—Alaska: 5 records, May 29 to June 20.

British Columbia: 5 records, June 5 to 27.

Maine: 30 records, May 28 to June 13; 23 records, May 30 to June 6, indicating the height of the season.

Pennsylvania: 16 records, May 25 to June 22; 11 records, May 31 to June 7.

Quebec: 8 records, May 22 to June 27; 5 records, May 26 to June 1 (Harris).

SEIURUS NOVEBORACENSIS NOTABILIS Ridgway

GRINNELL'S SMALL-BILLED WATERTHRUSH

HABITS

This northwestern race is described by Ridgway (1902) as similar to the eastern race, but "larger, especially the bill; coloration of upper parts less olive (more grayish sooty), that of under parts less yellowish usually white, with little if any yellow tinge. Young much darker above than that of *S. n. noveboracensis*, the feathers entirely dusky (except the buffy tip), instead of olive with a subterminal bar of dusky." He gives as its range—

> western North America; breeding from Minnesota (north of Red Wing), western Nebraska (Sioux County), and probably the more northern Rocky Mountain districts of the United States to Alaska (whole of wooded districts), and East Cape, Siberia; southward during migration throughout western United States (including Mississippi Valley), more rarely through Atlantic coast States (New Jersey, District of Columbia, Virginia, South Carolina, Florida, etc.), to the Bahamas (New Providence Island, February), Cuba (Santiago, November 18), island of Old Providence, Caribbean Sea, Cozumel Island, Yucatan, through Mexico and Central America to Colombia (Chirua, province of Santa Marta, February), and to Cape St. Lucas.

Dr. Nelson (1887) says of its range in northern Alaska: "In the wooded interior, as at the Yukon mouth, it is abundant, and, in fact, is one of the most common bush-frequenting birds throughout the entire fur countries, extending north even beyond the tree limit."

Its migration route seems to be mainly east of the Rocky Mountains, as it is apparently only accidental in California and farther south along the Pacific coast of Central America.

Nesting.—Baird, Brewer, and Ridgway (1874) give us the following short account of what were probably the first reported nests of Grinnell's waterthrush: "Among other memoranda given me by the late Mr. Kennicott was one furnished him by Mr. Lockhart, to the effect that, at Yukon River, June 21, 1859, he had shot a female Water Thrush as she flew from her nest. This contained five eggs, and was concealed under a small pile of drift, close to the river, but under large willow-trees. This was not lined with down. At the same locality another nest with six eggs was also obtained. This also was on the ground at the foot of some willows near the water. It was made of moss, and lined with very fine grass."

Henry C. Killingstad writes to me from Mountain Village, Alaska: "These birds nest wherever there is brush or tree growth. The presence of water is a foregone conclusion here where everything is wet. I found one nest on June 13, 1943, under the upthrust end of a piece of driftwood 20 feet from the Yukon. Earlier in the same month I saw several birds carrying nesting material along a spring-fed trickle through the alders north of the village. This little stream is not more than 2 feet across, but where it cuts into the tangled alders it makes many tunnels and labyrinths through which the birds can be found feeding day and night."

Richard C. Harlow has sent me the data for a nest that he found north of Belvedere, Alberta, on June 17, 1926; it was well-hidden in the overhanging upturned roots of a spruce tree, a foot above stagnant water, on the edge of a wet, swampy portion of the woods; it was made of leaves, weed stalks, mosses, and fern stalks.

Eggs.—Grinnell's waterthrush lays from 4 to 6 eggs to a set. These are apparently indistinguishable from those of the northern waterthrush. The measurements of 21 eggs average 19.1 by 14.4 millimeters; the eggs showing the four extremes measure **20.7** by 15.3, 19.8 by **15.4**, and **16.0** by **12.7** millimeters (Harris).

Voice.—Although he never made a record of it, Aretas A. Saunders tells me that, from his limited experience with it, he believes that the song of Grinnell's waterthrush is "distinctly different from that of the northern waterthrush." But published accounts indicate that there is a decided similarity in the songs of the two subspecies, which one would naturally expect to find. And H. C. Killingstad adds: "At Mountain Village, this bird does not act as it does in the States. Its loud, clear, and pleasing song is heard from bush and tree tops, one of the most characteristic voices in the bird chorus. This song is a pleasant surprise to one accustomed only to its metallic alarm note. For the past two summers, 1942 and 1943, a favorite singing perch of one of these birds has been the top of a 30-foot radio antenna pole in the middle of the village and only a few feet from an Eskimo cabin door. From this perch the song rings to both ends of the village, a half mile distant each way."

Fall.—William T. Shaw (MS.) thus pleasantly portrays an early stage in the fall migration of Grinnell's waterthrush: "When mid-August nights are cool in Saskatchewan and one awakens to morning sunrays slanting over low, wild meadows that glisten lightly with the white of frost, presently there comes from the margin of the sedge-grown, spring-fed lakelet nearby the sharp, evenly spaced call note of the waterthrush, early reminder of the southern drift of migration. Here, on August 20, 1943, this bird first came down out of the northern territory on its way out. It is water-loving and inhabits moist rims of streams and lakelets, comfortably shaded by trembling aspen, black poplar, and willow. It is noticeably solitary, more rarely coming in pairs during migration. Through the past few years, it has arrived with dependable regularity beside my camp at Livelong, in northwestern Saskatchewan, remaining a week or ten days through storm or shine as the weather happens to come, before it passes on. To find it, look low by the water's edge, among the outer radiating willow stems, now lightly touched with yellow tints of Autumn, where shade has all but banished grass growth, and dark, damp prairie soil soon emerges into the waters of the pool; there is found this oddly marked, graceful bird of trim sparrow size, but in mannerism and habit one uniquely set aside unto itself."

Arthur T. Wayne (1920) evidently considered Grinnell's waterthrush to be the prevailing form in South Carolina on migrations. He writes: "On one occasion during a heavy rain storm one night in September—I think on September 12, 1912—I saw vast hosts of Water-Thrushes in a swamp near my house on the morning of that day, there being in sight hundreds in the area of a hundred square feet, and I estimated that there must have been certainly twenty-five thousand or even more birds in the portion of the swamp I explored that day."

SEIURUS NOVEBORACENSIS LIMNAEUS McCabe and Miller

BRITISH COLUMBIA SMALL-BILLED WATERTHRUSH

HABITS

Thomas T. McCabe and Alden H. Miller (1933) have published a study of the geographic variation in the northern waterthrushes, to which the reader is referred, as it is too long to include here. From their study of the characters involved in these variations they conclude that a new name is desirable for the waterthrushes that breed in British Columbia. They summarize the subspecific characters of the new race as follows: "Dorsum between olivaceous black and dark grayish olive; underparts with yellowish averaging less than in *S. n. noveboracensis* but more than in *S. n. notabilis;* wing and tail averaging small; tarsus as in *notabilis*."

They give the breeding range as "central interior British Columbia, extending with some diminution of characters through northern British Columbia."

Its migration extends as far south as Panamá.

SEIURUS MOTACILLA (Vieillot)

LOUISIANA WATERTHRUSH

PLATES 60, 61

HABITS

The earlier ornithologists confused the two waterthrushes. Neither Wilson nor Nuttall recognized two species, and their accounts evidently referred partly to one and partly to the other. For example, Wilson (1832) speaks of one as passing through Pennsylvania to the north, and mentions the other as living in the cane brakes and swamps of Louisiana; both of these he called "Water Thrush—*Turdus aquaticus*"*;* but his description fits the Louisiana waterthrush, as we now know it. Nuttall's (1832) account is similar, though he uses the name *noveboracensis*, and his description follows Wilson. Audubon (1841) evidently recognized and figured both species, though his figure of the northern bird is apparently *notabilis*, and most of his remarks seem to refer to *motacilla*. Both species, however, had been recognized and named previously by European ornithologists, as shown in their present names.

The haunts of the Louisiana waterthrush have been variously described. Dr. Edgar A. Mearns (1879) writes: "Its notes cannot be dissociated from the sound of gurgling, rushing waters. * * * Even a casual allusion to this little bird recalls, to the mind of the collector, a bright picture of clear mountain streams, with their falls and eddies, their dams of rocks and fallen tree-trunks, their level stretches flowing over bright, pebbly bottoms, with mossy banks and rocky ferneries, and their darting minnows and dace; for only in such wild localities is the Water Wagtail at home."

Baird, Brewer, and Ridgway (1874) state that in the Wabash Valley, where it is an abundant summer resident, "it inhabits the dampest situations in the bottom-lands, the borders of creeks, lagoons, and swamps, living there in company with the Prothonotary Warbler." And in Knox County, Ind., William Brewster (1878) found it breeding on "the edge of a lonely forest pool in the depth of a cypress swamp." Although this species apparently shows a preference for the vicinity of running water, it seems content to live in surroundings where such streams are not to be found; however, the presence of water seems to be a decided necessity, hence it deserves its name.

Richard C. Harlow tells me that, "in the Pocono Mountains of Pennsylvania, where the northern waterthrush is very common and the Louisiana a common breeder, the normal nesting habitat of the northern species is in rhododendron bogs amid damp surroundings, but where water is slow-moving or stagnant, and where upturned roots of fallen, moss-covered trees abound. The Louisiana is here normally a bird of the fast-flowing trout streams, nesting in the banks or gullies near by. Both species may nest in overlapping zones, but they are much more frequent in the respective habitats indicated above."

Nesting.—One of the earliest, and one of the best, accounts of the nesting of the Louisiana waterthrush is by Mr. Brewster (1878); in Knox County, Ind.—

> a large tree had fallen into the shallow water, and the earth adhering to the roots formed a nearly vertical but somewhat irregular wall about six feet in height and ten or twelve in breadth. Near the upper edge of this, in a cavity among the finer roots, was placed the nest, which, but for the situation and the peculiar character of its composition, would have been exceedingly conspicuous. * * * The nest, which is before me, is exceedingly large and bulky, measuring externally 3.50 inches in diameter, by 8 inches in length, and 3.50 inches in depth. Its outer wall, a solid mass of soggy dead leaves plastered tightly together by the mud adhering to their surfaces, rises in the form of a rounded parapet, the outer edge of which was nicely graduated to conform to the edge of the earthy bank in which it was placed. In one corner of this mass, and well back, is the nest proper, a neatly rounded, cup-shaped hollow, measuring 2.50 inches in diameter by 2.50 inches in depth. This inner nest is composed of small twigs and green mosses, with a lining of dry grasses and a few hairs of squirrels or other mammals arranged circularly.

A second nest was found 2 days later on the opposite side of the same pond; it was similarly located and constructed, but square in shape to fit the hollow. Another was found "on the shore of an isolated little woodland pond. The site, in this instance, was at the foot of a huge stump, the nest being placed in a cavity in the rotten wood."

A very different nesting site, in a gorge near Ithaca, N. Y., is thus described in some notes sent to me by Dr. Alexander F. Skutch: "At length, I entered a very narrow and deep portion of the gorge, into which the stream poured by way of a murmuring fall, and then proceeded along the bottom through a trough in the rock. The walls of the chasm rose steeply up to a height of 40 or 50 feet, either in precipitous slopes overgrown with hemlock, spiked maple and Canadian yew, or else in quite vertical cliffs of bare rock, their faces broken into a myriad fragments by the shattered edges of the strata. Here and there, rooted in a deeper niche in the cliff, a belated columbine held its nodding scarlet blossoms.

"As I passed downward through the narrow defile, an inconspicuous brown bird darted out from a niche almost at the foot of the wall to my left, and flew quietly downstream ahead of me. The brown feathers which concealed them gone, the whitish eggs caught my eye in a twinkling; and there, in plain view, was my first Louisiana waterthrush's nest, scarcely concealed in its little niche in the moss-covered cliff. It was a firm, well-made but shallow cup constructed, on a foundation of dead leaves, of fine herbaceous stems, more half-decayed leaves interspersed with a little moss, and lined up fine rootlets and fibers, I believe, from decayed fern stipes."

Of 14 Pennsylvania nests, for which T. E. McMullen has sent me the data, all but one were over or close to water along the banks of streams, either in the banks or under the roots of trees; the other was in the upturned roots of a tree in a swamp.

I have seen but two nests of the Louisiana waterthrush in southern New England. The first was near the eastern limit of the breeding range of the species, in Kingston swamp, R. I., a locality described under the northern waterthrush, and was within 100 yards of occupied nests of the northern species and of the winter wren. Located in the upturned roots of a fallen tree, 12 inches above the pool of water that filled the cavity left by the uprooted tree, it was made of dead leaves, moss, and rootlets, and was lined with finer pieces of the same materials and with some white deer hair.

At Hadlyme, Conn., on May 19, 1934, while following two companions along the banks of a small, quiet brook that wound its way through some low, swampy woods of maples, black and yellow birches, oaks, beeches, dogwoods, ironwoods, laurels, and azaleas, with plenty of skunkcabbages, I saw a bird flush out behind them and fly across the brook. Its nest was soon found deeply hidden between the roots of and directly under the trunk of a large yellow birch within a yard of the brook. The nest, on a foundation of dead leaves, was made of fine grasses and rootlets, and was lined with the reddish, fruiting stems of mosses.

A nest found by Clarence F. Stone near Branchport, N. Y., was beautifully concealed under a mass of ferns that overhung a bank.

Eggs.—From 4 to 6 eggs constitute the usual set for the Louisiana waterthrush, 5 being the commonest number. The nest described above by Dr. Skutch held the remarkable number of 10 eggs, but these were probably the product of two females, for, otherwise, we have no record of more than 6 eggs in a nest, except where cowbirds' eggs had been added.

The eggs are ovate to short ovate and more or less glossy, usually only slightly lustrous. The ground color is white or creamy white, and the egg is speckled, spotted or blotched with "bay," "auburn," "chestnut," or "hazel," with under spottings of "light vinaceous-drab," "pale purplish drab," or "purplish gray." The eggs vary considerably, and may be almost immaculate, very finely speckled, or boldly blotched. In some cases the speckles are confluent over the entire egg and practically obscure the ground color, giving it a buffy white appearance. In general the markings are heavier at the large end. The gray spottings seem to be somewhat more prominent than on the eggs of the northern waterthrush. The measurements of 50 eggs average 19.9 by 15.5 millimeters; the eggs showing the four extremes measure **22.1** by 15.6, 21.0 by **16.3**, **17.8** by 14.8, and 18.3 by **14.7** millimeters (Harris).

Young.—The period of incubation is said to be about 14 days. The female probably does all of the incubating and brooding, but both parents assist in feeding and caring for the young, which are said to remain in the nest about 10 days. When partially fledged the colors of the young match their surroundings so well and they keep so still, with eyes closed, that they are easily overlooked, even in an open nest. The young are cared for by their parents for some time after they leave the nest and while they remain hidden in the surrounding underbrush.

Plumages.—Dr. Dwight (1900) records the natal down of the young Louisiana waterthrush as deep olive-brown, and describes the juvenal plumage as "above, deep olive-brown, without cinnamon edgings [thus differing from the young of *noveboracensis*]. Wings and tail darker, the coverts faintly tipped with cinnamon. Conspicuous line above and behind the eye dull white. Below, yellowish white, washed on the sides and crissum with cinnamon and narrowly streaked on the chin, throat, breast and sides with dull olive-brown."

The postjuvenal molt, involving the contour plumage and the wing coverts but not the rest of the wings or the tail, begins early in July. This produces the first winter plumage, which is similar to that of the juvenal. Dr. Dwight describes the first winter plumage as "above, deep olive-brown, much darker on the crown, which is bordered by conspicuous white superciliary stripes. The wing coverts are dark and without edgings. Below, white, buffy tinged and strongly washed on sides of the throat, flanks and on crissum with ochraceous buff. The chin is faintly flecked, the breast and sides streaked with olive-brown. Lower eyelid white; anteorbital spot and postocular streak dusky."

The first nuptial plumage is "acquired by marked wear through which the buff tints are largely lost, the flecks of the chin and the breast streaks diminished." Subsequently plumages are acquired by a complete postnuptial molt in July and by wear during the winter, the winter plumages of old and young birds being practically indistinguishable.

The sexes are alike in all plumages, and the molts are the same.

Food.—"Examination of the stomachs of 4 birds of this species from Florida showed their food to consist chiefly of insects and spiders. The insects included dragon flies, crane-fly larvae, grouse locusts, beetles, bugs, ants, caterpillars, and scale insects. Two of the birds had eaten small mollusks, and one had taken a killifish" (Howell, 1932).

Five stomachs, collected in Puerto Rico by Dr. Wetmore (1916), contained 98 percent animal matter and 2 percent vegetable food. "Remains of flies (33 percent) were present in three stomachs. Water beetles (Parnidae and others) were found in three stomachs and leaf beetles in two. In one bird was a tree hopper and in two others were indeterminate bug remains. A dragon fly was found once and spider remains and bits of a scorpion twice. Three-fourths of the contents of one stomach was composed of fragments of a snail, and in another was found a tree toad (*Eleutherodactylus* sp.). Two birds had eaten seeds, in one case those of the aji (*Capsicum* sp.)."

Behavior.—The two species of waterthrushes are much alike in their habits and movements; both of them are walkers and both have the peculiar habit of tilting the tail upward as if a spring holding it down had been suddenly released; both spend most of their time on or near the ground walking gracefully along the margins of streams or pools, or even in the shallow water, seemingly as devoted to the vicinity of water as is the water ouzel to the western mountain streams. Dr. Mearns (1879) describes the behavior of the Louisiana waterthrush very aptly as follows:

> It *runs* about (never hopping) over the stones and moss, gleaning along the sandy margin of the stream. Occasionally you may see it alight upon the witch-hazel, or alder bushes, that border the water, running dexterously along their branches. It always accompanies every employment with a Sandpiper-like, tilting motion of its body. Now it starts off in pursuit of one of its fellows. They fly through the forest with astonishing velocity, uttering a sharp twittering note, that sounds like the noise produced by striking two pebbles together. As they emerge higher up the stream, the chase is relinquished for the time, and you are surprised as they fly past to hear the clear notes of its song uttered as distinctly in mid-air as when perched; then the chase is renewed, but as they fly back again, one of the birds rises high up in the air above its pursuer, and then flutters slowly downward, pouring out its sweet song as it descends, mingling its cadence with the sound of the brook—the whole effect in perfect harmony with the spirit of the place. These performances take place oftenest early in the morning, about sunrise.

Voice.—Aretas A. Saunders sends me the following study of the song:

"The song of the Louisiana waterthrush is a loud, high-pitched one, exceedingly pleasing in its wild, sweet quality. Songs in my records vary from 6 to 19 notes, averaging about 11. The song is distinctly divisible into two parts. The first part consists of 2 to 4 rather slow notes or slurs, usually on or near the highest pitch, the notes most frequently being slurred upward. The second part consists of a series of 3 to 17 very rapid, twittering notes quite variable in form but usually descending in pitch. The average number of these notes is 8, and they are delivered two to three times as fast as those of the first part. The first part is distinctly sibilant and the second rather chattery, with rarely any of the liquid consonants that characterize the northern waterthrush.

"The pitch of the songs varies from C sharp''' to E''''. Single songs vary from two tones to an octave in range, averaging about three tones. The song begins high and usually becomes lower at or near the end. In all but 6 of my 49 records the first notes are on the highest pitch. In 30 of the records the last note is the lowest. The pitch of the rapid notes in the second part of the song is exceedingly variable, rarely with two notes in succession on the same pitch. The pitch varies up and down between single notes, though the general trend is usually downward.

"The song, in my timed records, varies from 2 to 3⅕ seconds, but several records that were not timed may have been somewhat longer. The notes of the first part are delivered at a rate of only two or three to the second, but those of the second part may be at a rate of six to ten; however, individual notes in the second part vary in length, so that the time is very irregular.

"Louisiana waterthrushes sing abundantly when they first arrive. As nesting starts the song is less frequent. I believe that individual birds cease singing for a time, perhaps for the period of incubation. In June the song seems to be longer and more elaborate. Most of my June records have more notes than those of April and May. The song ceases in late June, but I have too few records to give average dates. It is sometimes revived in July, evidently after the molt."

Albert R. Brand's (1938) records of frequencies in bird songs show the song of this species to be somewhat higher in pitch than that of the northern waterthrush, the vibrations per second varying from 6,600 to 2,475, with an approximate mean of 4,000, about the average of passerine song.

Two impressions of the song are worth noting. Dr. Skutch says of hearing it in a gorge near Ithaca, N. Y.: "A Louisiana waterthrush, perching upon a twig of a hemlock tree far above the stream, was singing in a ringing voice that rose above the murmur of the falling waters. *Chirp*, *chirp*, *chirp*, *chirp*, his song began boldly; then, as though he were suddenly confused in his recitation, broke into a lisping and incoherent garble impossible to paraphrase in human sounds. Such is always the character of their song; they have never learned the end of it." And Dr. George M. Sutton (Todd, 1940) describes the startling song as follows:

> Three distinctly repeated notes introduce this striking volley, which is entirely unlike the song of other warblers and much stronger and more prolonged than that of the species' near relative, the Northern Waterthrush. It is delivered either from the ground or from a tree, and sometimes even during flight. The head of the singer is thrown well back, his whole body is shaken with energy, and his usually restless tail is for the moment allowed to hang at an easy, downward angle. * * * The evening flight song, as I have heard it in Greene County, is a memorable performance. In the gathering dusk the singer himself is not seen. The song seems to be dashing here and there. It sweeps downward in jerking stages as the final measures decrease in volume. It is prolonged, and the latter half is a repetition of tinkling notes that fade away to nothingness as the bird plunges back into the darkness whence he came.

Field marks.—The Louisiana waterthrush most closely resembles the northern waterthrush, from which it can be distinguished by its broad, white superciliary stripe and its whiter under parts with less and duller streaking, its chin and throat being nearly immaculate. It looks a little like its relative, the ovenbird, but the latter has an eye ring and no stripe over the eye.

Enemies.—This waterthrush is a frequent victim of the cowbird, except in heavily wooded regions, where the cowbird is less likely to penetrate. Dr. Friedmann (1929) lists 3 nests that contained 4 eggs of the cowbird, 7 containing 3, and 45 other nests that held 1 or 2 eggs of this parasite. Three or four eggs of the cowbird are likely to cause the waterthrush to desert the nest.

Harold S. Peters (1936) lists only one tick, *Haemaphysalis leporis-palustris* Packard, as an external parasite.

Winter.—Dr. Skutch contributes the following account: "In Central America, the Louisiana waterthrush is a moderately abundant fall and spring transient, but in most parts at best a rare winter resident. During the southward migration, at least, it passes along both sides of the Cordillera, but in greater numbers on the Caribbean side, from late August well into October. As a winter resident, it appears to be confined to the Caribbean lowlands in both Guatemala and Costa Rica. For the spring months, there are records for the Caribbean lowlands and the central highlands, but apparently none for lower elevations on the Pacific side—a gap which may some day be filled. This, at least, is the story told by the few records before me as I write; but it is likely that some modifications of statement would be made necessary by a greater number of observations. Both the Louisiana and the northern waterthrushes are shy and difficult to approach while in Central America. It is not easy to see them sufficiently well to distinguish them in the field, especially where the presence of *Seiurus noveboracensis notabilis*, with its white superciliary lines, adds to the possibility of confusion with the Louisiana waterthrush. As a result, I have seen far more waterthrushes than I have distinguished as to species and set down in my records.

"While in Central America, the Louisiana waterthrush is usually seen foraging along the shores of streams or other bodies of water, whether rocky, sandy, or muddy. It is always alone and usually silent.

"Central American occurrences are: Guatemala—Motagua Valley near Los Amates, not uncommon spring transient, April 20 to May 2, 1932; Sierra de Tecpán, 8,500 feet, rare transient, February 12 and 28, 1933 (probably same individual on both dates). Honduras—Tela, abundant fall transient, arriving August 25, rare winter visitant, January and February. Costa Rica—Caribbean lowlands to 2,000 feet: fairly abundant fall transient, Río Sicsola, September 3, 1904, and El Hogar, August 28, 1906 (Carriker); rare winter resident, Pejivalle, January 23, 1934. Central highlands: Volcán Irazú, October 13 (Underwood) and San José, March 9, 1889 (Cherrie). Basin of El General, 2,000–3,000 feet, uncommon fall transient, September 30, 1936 and October 14, 1942."

From Central America, the three waterthrushes extend their winter ranges southward into northern South America and eastward to the Bahamas and the West Indies. In Florida, they seem to be rare or casual in winter.

Dr. Wetmore (1916) says: "The Louisiana water-thrush is a fairly common winter visitant to Porto Rico. The birds may arrive in September, though there are no positive records, and the first that I saw were at Cayey January 17. They were common in the mangrove swamps along the coast and inland followed the rapid streams, frequenting the parts bordered by brushy growth or running through coffee and banana plantations. The call note is noticeably higher than that of the other waterthrush, from which it can readily be distinguished."

DISTRIBUTION

Range.—Eastern Canada and the United States, the West Indies, Central America, and northwestern South America.

Breeding range.—The Louisiana waterthrush breeds **north** to southeastern Minnesota (Hutchinson, Minneapolis, and southern Pine County); central Wisconsin (probably Durand, Reedsburg, and New

London); southern Michigan (Grand Rapids, Lansing, Flint, South Lyon, and probably Port Huron); southern Ontario (Komoka, London, and Webster's Falls); central and eastern New York (Medina, Rochester, Canandaigua, Utica, Point Comfort, Warren, and Port Henry); southern Vermont (rarely Brattleboro); and central-southern New Hampshire (Harrisville and Dublin). **East** to New Hampshire (Dublin); more regularly to central-southern Massachusetts (Sheffield, Springfield, and Ware); Rhode Island; central New Jersey (Crosswick, Princeton, and Elizabeth); central Maryland (Patuxent Wildlife Research Refuge and Wildacres); eastern central Virginia (Lawrenceville and Ashland); central and northeastern North Carolina (Clinton, Garner, Greenville, and Walke); central South Carolina (Aiken and Columbia); and southwestern and central Georgia (Blakely and Macon). **South** to Georgia (Blakely); southern Alabama (Abbeville); southern Mississippi (Brooklyn); northern and southeastern Louisiana (Mansfield, Bienville, Como, Bains, and Baton Rouge); and northeastern Texas (Corsicana). **West** to northeastern Texas (Corsicana); eastern Oklahoma (Tulsa County, Washita River, and Kiowa Agency); eastern Kansas (Manhattan, Topeka, and Neosha River); eastern Nebraska (London and Fontanelle Forest); central western and central northern Iowa (Pottawattamie County and Emmetsburg); and southeastern Minnesota (Hutchinson).

Winter range.—The Louisiana waterthrush winters **north** to southern Mexico; Jalisco (Mazatlán); Morelos (Cuernavaca); Puebla (Metlatoyuca); Veracruz (Jalapa, Motzorongo); Tabasco (Frontera); and Yucatán (Mérida); Cuba (Bahia Honda, Isle of Pines, Trinidad, and Guamo); the eastern Bahamas (Bimini and Berry); and Puerto Rico. **East** to Puerto Rico; the Virgin Islands; and the northern Lesser Antilles (Barbuda, Antigua, Montserrat, Guadeloupe, and Dominica). **South** to the Lesser Antilles (Dominica); central and northeastern Colombia (Santa Marta, Villavincencia, La Bonda); and western Panamá (Permé). **West** to western Panamá (Permé); and southern Mexico (Jalisco). Also winters in Bermuda, and there is one sight record from Trinidad. Accidental in California (Mecca).

Migration.—Late dates of spring departure are: Colombia—Fusugasugá, March 24. Costa Rica—El General, March 23. Guatemala—near Quiriguá, May 2. Yucatán—Mérida, March 29. Veracruz—Arroyo del Sitio, March 25. San Luis Potosí—Valles, March 25; Tamaulipas—Gómez Farías region, April 4; Chihuahua—Alamos, March 28. Trinidad—April 23. Puerto Rico—Cartagena Lagoon, April 22. Haiti—Rivière Seche near Fonds des Nègres, April 2. Cuba—Villalba, April 18.

Early dates of spring arrival are: Florida—Lower Suwannee River, March 10; Pensacola, March 16. Alabama—Woodbine, March 9. Georgia—Atlanta and Fitzgerald, March 9. South Carolina—Spartanburg, March 20. North Carolina—Raleigh, March 14 (average of 23 years, March 29). Virginia—Naruna, March 8; Rockbridge County, April 2. West Virginia—French Creek, March 19 (average of 17 years, March 31). District of Columbia—Washington, March 25 (average of 31 years, April 9). Maryland—Forest Glen, March 26. Delaware—Kent and Sussex Counties, April 1 (average of 16 years, April 10). Pennsylvania—Sewickley, March 30. New Jersey—Newark, March 28. New York—New York City, April 2; Ithaca, April 4. Connecticut—Kensington, March 30. Rhode Island—Hopkinton, April 10. Massachusetts—Easthampton, April 5. Vermont—West Dummerston, April 24. New Hampshire—New Hampton, May 5. Louisiana—Baton Rouge region, March 14. Mississippi—Saucier, March 8. Arkansas—Rogers, March 10. Tennessee—Nashville, March 16 (average of 12 years, March 22). Kentucky—Barbourville and Bardstown, March 20. Missouri—southeastern, March 12; St. Louis, March 29. Illinois—Forest Park, March 28; Murphysboro and Springfield, March 31. Indiana—Monroe County, March 20; Helmsburg, March 30. Ohio—central Ohio, March 7 (average April 7). Michigan—Battle Creek, April 6. Ontario—Toronto, April 1 (1950); London, April 22. Iowa—Iowa City, April 2. Wisconsin—Milwaukee, April 4 (1948), April 7 (1947); St. Croix Falls, April 15. Minnesota—Lanesboro and Minneapolis, April 17 (average of 21 years for southern Minnesota, April 25). Texas—Refugio County, March 17; Gainesville, March 21. Oklahoma—Tulsa County, April 8. Kansas—Independence, April 1. Nebraska—Peru, April 20. South Dakota—Sioux Falls, April 28.

Late dates of fall departure are: South Dakota—Sioux Falls, September 8. Nebraska—Lincoln, September 30. Minnesota—Minneapolis, September 20 (average of 8 years for southern Minnesota, August 27). Wisconsin—Reedsburg, September 27. Iowa—Wall Lake, September 29. Ontario—Credit Run, Peel County, August 23; Point Pelee, August 28. Michigan—Kalamazoo, October 18. Ohio—Hillsboro, October 10; central Ohio, October 11 (average, September 18). Indiana—Indianapolis, October 23. Illinois—Evanston, September 28. Missouri—Columbia, October 24. Kentucky—Bowling Green, October 18. Tennessee—Elizabethton, October 30. Arkansas—northwestern, October 4. Mississippi—Gulfport, October 29. Louisiana—Baton Rouge region, October 25. Massachusetts—Lenox, August 23. Connecticut—Groton, August 15. New York—New York City, October 3 and November 24. New Jersey—Morristown, October 20. Pennsylvania—Renovo, October 10. Delaware—Kent and

Sussex Counties, September 28 (average, September 15). Maryland—Baltimore County, September 24. District of Columbia—Washington, October 4 (average of 8 years, September 19). West Virginia—French Creek, October 7. Virginia—Lawrenceville, October 19. North Carolina—Waynesville, September 29. Georgia—Macon, October 12. Alabama—Leighton, October 12. Florida—Alachua County, October 27; Fowey Rocks, November 2.

Early dates of fall arrival are: California—Mecca, August 17 (only record for State. Oklahoma—Tulsa County, August 9. Texas—Cove, August 29. Wisconsin—Racine, August 9. Ohio—Buckeye Lake, August 27 (average, September 1). Illinois—La Grange, August 18; average for Chicago region, September 3. Tennessee—Elizabethton, August 23. Mississippi—Bay St. Louis, July 4. Louisiana—Mandeville, August 18. New York—New York City, August 4. South Carolina—Mount Pleasant, July 13. Florida—Pensacola, July 13; Old Town, July 23; Fort Myers, August 4. Bermuda—September 4. Cuba—Habana, August 10. Jamaica—Trelawney, September 5. Dominican Republic—Puerto Plata, August 12. Puerto Rico—Mona Island, August 18. Antigua—September 19. Dominica—September 25. Tamaulipas—Río Sabinas, August 5. Guatemala—Peten, August 11. Honduras—Lancetilla, August 24. Nicaragua—Escondido River, October 23. Costa Rica—El Hogar, August 28. Panamá—Cricamola, August 24.

Egg dates.—Connecticut: 43 records, May 7 to June 6; 25 records, May 12 to 25, indicating the height of the season.

New Jersey: 26 records, May 11 to June 24; 21 records, May 17 to 22.

North Carolina: 10 records, April 2 to May 14.

Pennsylvania: 26 records, May 6 to June 6; 13 records, May 11 to 17 (Harris).

OPORORNIS FORMOSUS (Wilson)

KENTUCKY WARBLER

Plate 62

HABITS

Wilson (1832) discovered this handsome warbler and named it for the State in which he found it most abundant. The name is not inappropriate, for Kentucky is not far from the center of its abundance in the breeding season. Its summer range covers most of the eastern half of the United States, chiefly in the Mississippi Valley, but it extends northward to southern Minnesota, southern Ontario, Ohio, and Pennsylvania, and southward to the Gulf States. Eastward, it breeds locally from the lower Hudson Valley, New York, to North

Carolina, but it is rare east of the Alleghenies in the southeastern States.

The Kentucky warbler is a woodland bird, a lover of deep shade and dense, damp thickets. Ridgway (1889) says that it "is one of the most abundant of birds in the rich woods of southern Illinois. As far north as Wabash, Lawrence, and Richland counties, it is even more abundant than the Golden-crowned Thrush, though the two usually inhabit different locations, the latter preferring, as a rule, the dryer upland woods, while the present species is most abundant in the rich woods of the bottom-lands."

Franklin L. Burns wrote to Dr. Chapman (1907) from Berwyn, Pennsylvania: "It is here an inhabitant of the overgrown clearings, swampy thickets, and the borders of woodland; a bird of the south, loving the luxuriant undergrowths of spicewood, ferns, mandrake, skunk cabbage, and other shade-loving plants of rank growth."

Andrew Allison wrote to Dr. Chapman (1907) that, in Mississippi, this warbler inhabits "undergrowth in damp, or, at least, heavily shaded, woods. It may frequent the thickets of rose-bay (*Illicium*) and the tangle of bamboo briers on the Gulf coast, the varied tangled growth along the creeks and rivers of the higher regions, or the brakes of switch-cane; but it always selects a low, thick growth, where it feeds almost entirely on the ground."

In the central Allegheny Mountain region, according to Prof. Maurice Brooks (1940), "the birds seem at home in a number of forest types, southern mixed hardwoods, scrub and pitch pine mixtures, oak-hickory, and northern hardwoods. * * * As with many other sylvan birds, ravines seem especially to attract them."

Spring.—From its winter home, from southern Mexico to Colombia, the Kentucky warbler moves northward mainly in April. While a few individuals may cross from Yucatán and Cuba to Florida, it is evidently rather rare on that side of the Gulf of Mexico. The main migration route of the great bulk of these birds is northward and northeastward through Texas to the Mississippi Valley, where its center of abundance in summer is in the bottom-land forests of the great rivers, mainly west of the Alleghenies and east of the great plains. M. A. Frazar (1881) saw "large numbers" of Kentucky warblers migrating across the Gulf of Mexico, when his ship was about 30 miles south of the mouth of the Mississippi River; they had apparently come from Yucatán and were flying due north.

Nesting.—Dr. Alexander F. Skutch writes to me: "A nest found near Baltimore, Md., on May 31, 1934, was concealed among a vigorous stand of *Sanicula marilandica* in low and moist but not swampy ground in light woods. The bottom of the nest was about 2 inches above the ground. In form, the structure was a bulky, open cup. The very thick outer layer contained about 200 dead leaves which were whole or nearly whole, chiefly medium-sized leaves of oak, beech, and red maple. The inner lining, very thin in comparison with the bulky outer wall, consisted of fine rootlets and other fibrous material. The nest contained two proper eggs and one of the cowbird.

"The female, if she happened to be incubating or, later, brooding the nestlings at the time of my visits, would sit bravely facing me while I looked down at her with my head scarcely more than a foot distant from her. When I tried to touch her, she jumped abruptly from the nest and walked slowly over the ground with the tips of her wings dragging, chirping excitedly.

"I have another record of a nest found near Baltimore on June 22, 1934. It was in weedy open woods, on the ground at the foot of a bush. It contained four newly laid eggs."

F. L. Burns (Chapman, 1907) says:

> The nest is often placed in the most unexpected places: It may be on top of the ground at the foot of a beech, spice-bush, dog-wood, sweet birch, or black haw sprout; under a fallen bough, or perhaps just off the wet earth between the ground forks of a bunch of spice-wood, winter fern, Spanish needles or other weeds; or less frequently, in the midst of a patch of wild sarsaparilla, mandrake or other annuals, with nothing to turn aside the crushing foot of man or beast. It is usually well concealed by the surrounding vegetation while in a comparatively open spot, and if not directly in an abandoned cartroad, not far from some woodland footpath, public road, or the edge of the woods.
>
> A rather bulky and loosely constructed nest, outwardly of somewhat ragged dead leaves of the chestnut, beech, cherry, maple, white, black and chestnut oak, a few weed or grass stems, an occasional strip of wild grapevine bark, and, once, many green leaves of the dogwood, and, in another example, several oak blossoms; usually followed by an inner layer of bright, clean dead leaves of the beech, lined with black rootlets and in fully half of the nests examined, a few long black horse-hairs. In one instance the lining was of light-colored rootlets. Another nest, so well hidden in a patch of woodplants that I accidentally trod upon it while actually searching for it, was a most frail affair built exclusively of grasses, lined with black rootlets, however.
>
> During the nest building period the birds are so extremely jealous and watchful, deserting the site rather than be spied upon, that I have been unable so far to follow this interesting period to a finish. The male unquestionably aids his mate.

Charles F. De Garis (1936) has published an interesting paper describing six nests of the Kentucky warbler, among which was one peculiar nest in an unusual situation. It was placed in a fence corner of a garden in an open situation.

> There was no trace of logs or lichens, ferns or vines, no shelter of any kind, in fact nothing but a heap of clods and leaves raked from the garden. * * *
>
> With the purpose of offering her a choice of artificial materials, I worked till dark assembling bits of plain and colored string, thread, cotton and wool, and such fragments of ribbon and rayon as I could find. When the female came, the next morning, she "made several trips for grass before taking any notice of

my bargain counter display. Finally she became interested in a bit of brown sweater wool, which she promptly conveyed to the nest. Then followed white string, green string, yellow ribbon and the like, taken with little or no deliberation. A piece of pale blue rayon gave her pause, but after shredding it a while she took it on to the nest. However, she eschewed all materials of carmine, scarlet and purple.

The only nest of the Kentucky warbler that I have ever found was in a typical situation in a large tract of heavy, deciduous, upland woods in Delaware County, Pa., ón June 8, 1896. I had been hunting carefully and thoroughly over a limited area in which the male had been singing and flitting about in an apparently unconcerned manner, when I flushed the female from her nest almost at my feet; she fluttered along the ground as if with a broken wing. The nest was only partially concealed beneath the leaves of two very small spice-wood saplings. It was built up some 4 or 5 inches above the ground between the two saplings with a great mass of beech and other hardwood leaves; the inner nest was made of weed stems and rootlets and was lined with finer rootlets and a little cowhair. It held five half-incubated eggs.

Eggs.—The Kentucky warbler lays from 3 to 6 eggs to a set; sets of 3 are perhaps incomplete and sets of 6 are rare. In a typical series of 30 sets there are 13 sets of four, 10 sets of 5, and only 2 sets of 6. The shape varies from short ovate to elongated ovate, and they are only slightly lustrous. The white or creamy white ground color is speckled, spotted, and sometimes blotched with shades of "bay," "auburn," or "chestnut," with undertones of "Quaker drab" or "light mouse gray." Although some eggs are rather boldly marked with blotches, the majority seem to be speckled or finely spotted. On some the speckles are very dense, on others they may be sparsely scattered over the entire surface or concentrated at the large end. The measurements of 50 eggs average 18.6 by 14.3 millimeters; the eggs showing the four extremes measure **20.4** by **15.7, 16.8** by 13.7, and 17.8 by **12.7** millimeters (Harris).

Young.—At a nestful of eggs, marked and carefully watched, Mr. De Garis (1936) found that "after twelve days' incubation all four eggs hatched, and after ten days of nest-feeding the vigorous brood of four was brought off. * * * I found that each egg was turned on its long axis once, sometimes twice, every twenty-four hours, and that the relative position of the eggs to each other was variously altered from time to time."

Evidently, all the incubating and brooding was performed by the female, and "the burden of feeding the young was assumed very unequally by male and female. The male continued to devote most of his waking hours to musical exercise, and only rarely passed on a small moth or fly to his mate." When the time came for the young to leave the nest, the female came near the nest with tempting food, but would not feed the crying young until she had persuaded them to leave. After that they were fed by both parents for as much as 17 days. At other nests, he found incubation to last 13 days, and the young were nest-fed 8½ days.

Mr. Burns (Chapman, 1907) says that "the eyes of the young are opened on the fifth day and in two instances birds left the nest on the eighth day. If the too inquisitive observer is noticed lurking around, the female will frequently drive the young from the nest prematurely. The male, while protesting vigorously, seldom approaches as closely as the female."

Dr. Skutch (MS.) relates the following interesting experience: "At about noon on June 16, 1934, while following up a small rivulet flowing through an extensive woodland in Baltimore County, Md., I entered a low, swampy area surrounding the channel, almost devoid of trees, but overgrown with spice-bush and skunk cabbage. As I came into this natural clearing, a pair of Kentucky warblers flitted nervously about, uttering loud, full chirps. I suspected they had a nest in the low ground, and stood quietly at one side, hoping that they would eventually reveal its location to me. After a period of excited chirping, one of them found a larva and flew with it to the far side of the opening. After hesitating a minute or so, it flew down and disappeared among the herbage with its burden. I crossed the swamp and began to search among the skunk cabbages and sedges in the spot where the parent had disappeared. When I had gone beyond the area where I expected to find the nest—the parents meanwhile flitting excitedly around me—I was brought suddenly to a halt by a loud explosion of small bird voices that seemed to arise from my very feet. Looking downward, I beheld three or four little olive birds hopping rapidly away in as many directions, while the parents were driven to renewed chirping and excitement. Not two inches from my right foot was the nest, now entirely deserted, a bulky open cup of dead leaves lined with fibrous material. It rested upon the ground at the base of a skunk cabbage plant at the edge of the swamp.

"I pursued one of the little birds, who tried to escape by hopping, and finally capturing it, found that it bore little resemblance to its parents. * * * Meanwhile one of the parents, probably the mother, crept slowly and painfully over the ground at a safe distance from me, dragging her relaxed wings and her tail; while the other flitted about holding in his bill a larva which he was too excited to deliver to a youngster."

Plumages.—Dr. Dwight (1900) describes the juvenal plumage of the Kentucky warbler, in which the sexes are alike, as "above, including sides of head rich olive-brown. Wings and tail rather darker, edged with deep olive-green, the wing coverts with wood-brown. Below, pale raw umber-brown, Naples-yellow on the abdomen and crissum."

A partial postjuvenal molt in July, involving the contour plumage and the wing coverts but not the rest of the wings or the tail, produces the first winter plumages, in which the sexes are recognizable. In this plumage, the young male is "above, olive-green including the wing coverts. Below, including superciliary stripe, bright canary-yellow. The forehead, crown, lores and auriculars are partly black much veiled by smoke-gray edgings." The first nuptial plumage is acquired by a partial prenuptial molt "which involves a part of the head, chin and throat, but no other areas. The black crown with plumbeous edgings, the black lores, auriculars and a short extension on the sides of the neck are assumed, together with the yellow feathers of the chin and superciliary stripe. Young and old become indistinguishable."

A complete molt in July produces the adult winter plumage, which "differs from first winter in the crown being grayer, the black areas more defined and the edgings clear plumbeous gray, veiling the black much less." He says that the adult nuptial plumage is "acquired apparently by a partial prenuptial moult, as in the young bird, although wear alone may modify the winter plumage after the first year." Females differ from males in all the later plumages, the black markings being duller and more restricted.

Food.—No extensive study of the food of the Kentucky warbler is available. Forbush (1929) says: "The food of this bird consists in part of grasshoppers and locusts, caterpillars and the larvae of other insects, moths, plant-lice, grubs, spiders and other animal food that it finds chiefly on or near the ground, or in bushes, vines or the lower parts of trees. In summer it takes some berries." A. H. Howell (1924) reports that the stomachs of two birds, taken in Alabama, contained remains of bugs, beetles, ants, and other Hymenoptera.

Behavior.—The Kentucky warbler is essentially a ground warbler, and, like others of similar habits, it walks gracefully along rather than hopping; it shares to some extent with the waterthrushes the habit of bobbing its tail, though this habit is no more pronounced than it is with the ovenbird. John Burroughs (1871) classes him with the ground warblers and says that "his range is very low, indeed lower than that of any other species with which I am acquainted. He is on the ground nearly all the time, moving rapidly along, taking spiders and bugs, overturning leaves, peeping under sticks and into crevices and every now and then leaping up eight or ten inches, to take his game from beneath some overhanging leaf or branch. Thus each species has its range more or less marked. Draw a line three feet from the ground, and you mark the usual limit of the Kentucky warbler's quest for food." Ridgway (1889) writes:

> In its manners it is almost a counterpart of the Golden-crowned Thrush, but is altogether a more conspicuous bird, both on account of its brilliant plumage and the fact that it is more active, the males being, during the breeding season, very pugnacious, and continually chasing one another about the woods. * * * Considering its great abundance, the nest of this species is extraordinarily difficult to find; at least this has been the writer's experience, and he has come to the conclusion that the female must slyly leave the nest at the approach of the intruder and run beneath the herbage until a considerable distance from the nest, when joined by her mate, the pair by their evident anxiety mislead the collector as to its location. However this may be, the writer has never found a nest of this species except by accident, although he has repeatedly searched every square foot of ground within a radius of many yards of the spot where a pair showed most uneasiness at his presence.

Other observers have commented on this same trait. And Amos W. Butler (1898) refers to its resemblance to the ovenbird in its actions, saying: "It carries its body evenly balanced, apparently, and the equilibrium is only maintained with much difficulty by using its tail as a balance, causing that appendage to bob up and down. Hopping about a steep, springy bank, it reminds one of the Worm-eating Warbler, as it climbs over roots, sticks and logs, now disappearing from view in a hole beneath the roots, then behind a log, here stopping to peck at an insect, and there turning over the leaves."

Voice.—Dr. Chapman (1912) writes:

> His song is entirely unlike that of any other Warbler. It is a loud, clearly whistled performance of five, six, or seven notes—*tur-dle, tur-dle, tur-dle*—resembling in tone some of the calls of the Carolina Wren. Even in the woods it may be heard at a distance of about one hundred and fifty yards. In the height of the breeding season this Warbler is a most persistent singer. On one occasion, at Englewood, N. J., I watched a male for three hours. During this period, with the exception of five interruptions of less than forty-five seconds each, he sang with the greatest regularity once every twelve seconds. Thus, allowing for the brief intervals of silence, he sang about 875 times, or some 5,250 notes. I found him singing, and when I departed he showed no signs of ceasing.

F. L. Burns wrote to Dr. Chapman (1907):

> The song is a loud, clear and sweetly whistled peer-ry, repeated rapidly four or five times. Often, though less frequently, a *che che che peer-ry peer-ry peer-ry*. When first heard it is suggestive of the song of the Cardinal or Carolina Wren. During the nesting season it is an incessant singer from the lower branches of the sapling in which it is constantly moving or as often from the ground where it is at its best, walking about with an air and dignity not often attained by small birds. The song continues from arrival until June 27–June 23, and one was heard August 7, (1902). * * * A flight song is sometimes delivered about dusk during the height of the breeding period. It is indescribable. The alarm note is a metallic *chip*, *check*, or *chuck*, more or less rapidly repeated, and to a critical ear easily recognizable."

A. D. Du Bois tells me that the song reminds him of the *pe-to* note of the tufted titmouse; Francis H. Allen gives me his impression of it as sounding like *wittly wittly wittly wittly wittly wittly;* other recorded renderings are similar, but those I have cited are sufficient to give a good idea of the striking and characteristic song of the Kentucky warbler.

Field marks.—The olive-green upper parts, with no white in wings or tail, the under parts wholly bright yellow, and the black markings on the crown and sides of the head and neck are all distinctive field marks. In females and fall birds the colors are duller, and the black markings are more restricted and veiled but they show similar patterns.

Enemies.—This warbler is a common victim of the cowbird. Dr. Friedmann (1929) had 65 records, and says: "In Greene County, Pennsylvania, the Kentucky Warbler seems to be the commonest victim of the Cowbird. Jacobs found eggs of the parasite in 47 nests of this warbler, as follows: 39 nests with 1 Cowbird egg each; 7 nests with 2 Cowbird eggs each; 1 nest with 3 Cowbird eggs."

Snakes and prowling predators have been known to rob the nests of this and other ground-nesting species. Harold S. Peters (1936) recorded only one external parasite as found on this warbler, a tick (*Haemaphysalis leporis-palustris*).

Winter.—Dr. Skutch contributes the following: "Of all the wood warblers, resident or migratory, the Kentucky warbler is the species most often seen in the undergrowth of the heavy lowland forests of Central America. The one member of the family that breeds among the loftier forests of the lowlands, the buff-rumped warbler, haunts the rocky streambeds, and is rarely found among the undergrowth at a distance from water. The migrant warblers that winter in some abundance in these forests, as the chestnut-sided warbler and the American redstart, are birds of the tree-tops. This leaves the Kentucky warbler, with occasionally a worm-eating warbler, to represent its family in the company of antbirds, manakins, wood-wrens, and wintering russet-backed thrushes in the underwood.

"Not that the Kentucky warbler is abundant in these forests, even at the height of the northern winter. I have rarely seen as many as two, and still more rarely three, in a day's wandering through the forest. Nor is it restricted to the forest; for it haunts also the heavier, more humid second-growth. But in either habitat, it is always seen moving restlessly through the vegetation near the ground, often clinging to slender upright stems, ant-bird-fashion. It is always alone, unless in chance company with small birds of other kinds; it shows no true sociability at this season. It is silent, save for its reiterated, sharp call note.

"Arriving in September, the Kentucky warbler spreads over the length of Central America, including the lowlands of both coasts, wherever suitably humid conditions prevail, and winters at altitudes up to 3,500 or perhaps 4,000 feet above sea-level. It appears to depart early; until the present year I had only two records as late as April, one for the third and the other for the twelfth of the month. But this year, 1943, it was for a brief period in late March and early April rather abundant in the forests of this region of southern Costa Rica; and I saw it repeatedly until April 9.

"Early dates of fall arrival in Central America are: Guatemala—Chimoxan (Griscom), September 13. Honduras—Tela, September 11, 1930. Costa Rica—San José (Cherrie), October 7; Río Sicsola (Carriker), September 21; Basin of El General, October 8, 1936, and October 12, 1942.

"Late dates of spring departure are: Panamá—Barro Colorado Island, Canal Zone, March 28, 1935. Costa Rica—Basin of El General, April 3, 1936, February 26, 1937, March 11, 1939, April 12, 1940, February 23, 1942, April 9, 1943."

DISTRIBUTION

Range.—Central and eastern United States, Mexico, Central America, and northern South America.

Breeding range.—The Kentucky warbler breeds **north** to southeastern Nebraska (Lincoln and Omaha); eastern Iowa (Grinnell and Waukon Junction); southwestern and central southern Wisconsin (Wyalusing, Mazomaine, and Janesville); northeastern Illinois (rarely Chicago area); central Indiana (Rockville, Crawfordsville, and Indianapolis); southern and eastern Ohio (Oxford, Wilmington, Columbus, Corning, Wooster, Hartville, and Youngstown); and southeastern New York (rarely Ossining and Bronx). **East** to New York (Bronx); north-central New Jersey (probably Princeton and Elizabeth); southeastern Pennsylvania (Philadelphia); Delaware (Wilmington); southeastern Maryland (Plummers Island and Easton); eastern Virginia (Lawrenceville, Petersburg, and Ashland); central North Carolina (Charlotte and Raleigh); central South Carolina (Aiken and Summertown); central Georgia (Macon, Round Oak, and Carmichaels Pond); and northwestern Florida (Chipley). **South** to northwestern Florida (Chipley and Pensacola); southern Alabama (Mobile, Castleberry, and Dothan); southern Mississippi (Saucier, Gulfport, and Woolmarket); southern Louisiana (Sulphur, Iowa, Lottie, and Thibodaux); and southeastern Texas (Orange, Houston, Matagorda County). **West** to central Texas (Matagorda County, San Antonio, Kerrville, Waco, and Rhome); eastern Oklahoma (Copan, Stillwater, Fort Reno, Moore, and Kiowa Agency);

eastern Kansas (Blue Rapids, Fort Riley, Emporia, and Burlington); and southeastern Nebraska (Lincoln).

Winter range.—The Kentucky warbler winters in southern Mexico; (Isthmus of Tehuantepec, probably); Campeche (Apazote and Pacaytún); south through Central America to Panamá (Santa Fe, Paracote, Gatún, and Chepo); and northern Colombia (Río Frío, Bonda, and Don Diego).

Migration.—Late dates of spring departure are: Panamá—Loma del León, March 29. Costa Rica—San Isidro del General, April 19. British Honduras—Mountain Cow, April 13. Guatemala—Peten, April 15. Veracruz—Tres Zaptoes, April 8. Sonora—Rancho Santa Barbara, June 12.

Early dates of spring arrival are: Florida—Dry Tortugas Island and Pensacola, March 29. Alabama—Birmingham, April 5 (average for 10 years, April 7). Georgia—Macon, March 27; Atlanta and Kirkwood, April 1. South Carolina—Columbia, April 10. North Carolina—Old Fort, April 14; Raleigh, April 15 (average of 17 years, April 30). Virginia—Cape Henry, April 3. West Virginia—Kayford, April 21; French Creek, April 25 (average of 16 years, May 1). District of Columbia—Washington, April 25 (average of 30 years, May 2). Maryland—St. Marys City, April 19. Delaware—Kent and Sussex Counties, March 30 (average of 19 years, April 8). Pennsylvania—Swarthmore, April 28. New Jersey—New Brunswick, May 3. New York—Ossining, May 2; Orient, May 4. Connecticut—Kent, May 5. Massachusetts—Cambridge, April 28. Louisiana—Baton Rogue region, March 19. Mississippi—Bay St. Louis, April 1. Arkansas—Saline County, March 24. Tennessee—Nashville, April 15 (average of 12 years, April 17). Kentucky—Eubank, April 15. Missouri—southeastern, April 9. Illinois—Anna, April 12; Beecher, April 24. Indiana—Bloomington, April 17. Ohio—Columbus, April 17 (average, May 4). Michigan—Petersburg, May 4. Ontario—Hamilton, May 3. Iowa—Keokuk, April 26. Wisconsin—Winneconne, Madison, and Milwaukee, May 7. Texas—Corpus Christi, April 7; Houston, April 11. Oklahoma—Copan, April 19. Kansas—Manhattan, April 25. Nebraska—Omaha, May 7.

Late dates of fall departure are: Kansas—Lawrence, September 14. Oklahoma—Tulsa, September 19. Texas—Rockport, October 28. Wisconsin—Eau Claire, September 17. Iowa—Polk County, September 13. Ontario—Lynn Valley, September 9. Ohio—Buckeye Lake, September 29 (average, September 20). Indiana—Richmond, September 9. Illinois—Mount Carmel, October 15. Missouri—Columbia, September 18. Kentucky—Bardstown, September 28. Tennessee—Elizabethton, October 2. Arkansas—Saline County, October 5. Mississippi—Gulf coast, October 6. Louisiana—New Orleans, October 19. Nova Scotia—Sable Island, September 1 (only record). Massachusetts—Northampton, September 21. Connecticut—Hartford, September 26. New York—Belmont Lake, Long Island, October 2; Buffalo, October 1. New Jersey—Elizabeth, September 21. Pennsylvania—Jeffersonville, September 18. Delaware—Kent and Sussex Counties, September 18 (average of 19 years, September 5). Maryland—Baltimore County, October 11. Cumberland, September 28. District of Columbia—Washington, September 5. West Virginia—Bluefield, August 26. Virginia—Cape Henry, August 31. North Carolina—Raleigh, October 13 (average of 9 years, August 29). South Carolina—October 24. Georgia—Fitzgerald, September 28. Alabama—Birmingham, September 29. Florida—Pensacola, September 29; Chokoloskee, October 25.

Early dates of fall arrival are: Texas—Cove, July 17. Mississippi—Deer Island, July 31. South Carolina—Mount Pleasant, July 31. Georgia—Savannah, August 6. Florida—Jefferson County, August 6; Key West, August 24. Tamaulipas—Matamoros, August 26. Guatemala—Chimoxan, September 13. Honduras—Lancetilla, September 1. Salvador—Lake Olomega, September 1. Costa Rica—Río Sicsola, September 21. Panamá—Changuinola, Almirante Bay Region, October 4. Colombia—Bonda, Santa Marta region, October 7.

Egg dates.—Missouri: 6 records, May 10 to June 6.

Pennsylvania: 32 records, May 15 to June 28; 20 records, May 24 to June 2, indicating the height of the season.

OPORORNIS AGILIS (Wilson)

CONNECTICUT WARBLER

PLATE 63

HABITS

Wilson (1822) discovered this interesting warbler in Connecticut, described it, and named it for the State in which he first found it. He gave it the specific name *agilis*, because it "seemed more than commonly active, not remaining for a moment in the same position." Both names now seem inappropriate, for Connecticut is far from either its breeding range or its winter home; furthermore, recent studies of its habits show that it is not necessarily "more than commonly active", as it often remains perched for considerable periods.

Not much was known about it by either Wilson or Audubon, who regarded it as a very rare bird. For some 70 years after its discovery, nothing was known about its breeding range and nesting habits, until Ernest T. Seton (1884) found the first nest in 1883 in Manitoba. And for some years thereafter its home life and migrations remained clouded in mystery, but its life history and its ranges are now fairly well known. It is now known to breed in the Canadian Zone from central Alberta and southern Manitoba to central Minnesota, southern Wisconsin, perhaps northern Michigan, and southern Ontario; it spends the winter in South America, from Venezuela to southeastern Brazil, and perhaps in Colombia.

The locality in which Seton (1884) found it breeding is thus described by him: "A few miles south of Carberry, Manitoba, is a large spruce bush, and in the middle of it is a wide tamarack swamp. This latter is a gray mossy bog, luxuriant only with pitcher plants and Droseræ. At regular distances, as though planted by the hand of man, grow the slim straight tamaracks, grizzled with moss, but not dense, nor at all crowded; their light leafage casts no shade."

In Alberta the Connecticut warbler seems to prefer the small, dry, well-drained ridges, or the vicinity of poplar woods, at least such were haunts in which Richard C. Harlow and A. D. Henderson found their nests. The latter tells me that this was formerly a quite common breeding bird around Belvedere, but that now it is extremely rare. The general locality where they found it breeding "was one of small prairies, a few acres in extent, scattered through groves of poplars. I have also heard the call of the Connecticut warbler many times in poplar woods, in the Fort Assiniboine District, but never in the muskegs either there or at Belvedere. The Connecticut warbler in this locality is a bird of the poplar woods."

According to Dr. Roberts (1936), in Minnesota the Connecticut warbler "so far as discovered, makes its summer home in cold tamarack and spruce swamps of typical *Canadian Zone* character. Such places are numerous and wide-spread in northern Minnesota." But it has evidently not been found there in anything like the numbers found in Alberta under the conditions described. On the other hand, Ian McT. Cowan (1939) found it, in the Peace River District of British Columbia, established in its "territory in a grove of young aspens below an open stand of large poplars, aspens and white spruce."

Spring.—The Connecticut warbler is one of the few small birds that follow different migration routes in spring and fall. The spring route is through the West Indies and Florida, northwesterly across the southern Alleghenies, and then northward through the broad Mississippi Valley. It is rarely seen in spring east of these mountains and north of South Carolina and western North Carolina (Asheville). There are, however, scattering spring records, mostly sight records, as far north as Pennsylvania, New Jersey, New York, and Massachusetts. Todd (1940) lists only three spring specimens for western Pennsylvania, and says: "During its spring sojourn the Connecticut Warbler keeps in the shelter of low brush and thick undergrowth, especially in swampy places. Rarely does it venture more than a few feet above the ground, and it pays little or no attention to 'squeaking.'" Forbush (1929) mentions only one spring specimen for Massachusetts, but adds several sight records that he considers reliable.

Brewster (1906) says, however: "They never appeared in spring, nor is there a single record in which I have full confidence of their occurrence at that season in any part of Massachusetts."

In the Mississippi Valley, it is a common spring migrant, occurring rarely as far east as extreme western Pennsylvania, and more commonly from Ohio westward. At Buckeye Lake, Ohio, Milton B. Trautman (1940) calls it "among the last of the warbler transients to appear," and says: "In spring this warbler was found almost entirely in brush tangles of the remnant swamp forests, and on only 2 occasions was an individual seen in the upland type of woodlands."

George H. Lowery, Jr. (1945), advances some grounds for assuming that this and the mourning warbler "are at least in part" migrants across the Gulf of Mexico to the Mississippi Valley.

Nesting.—Seton (1884) tells of finding the first nest of the Connecticut warbler: "As I went on, a small bird suddenly sprang from one of the gravelike moss-mounds. It seemed distressed, and ran along with its wings held up, like a Plover just alighting. On seeing that I would not be decoyed away, it ran around me in the same attitude. Recognizing that it was the Connecticut Warbler, I took it, and then sought out the nest in the moss. It was entirely composed of dry grass, and sunken level with the surface."

Forty years elapsed before any more nests were reported. These were found by Richard C. Harlow, with the help of A. D. Henderson, near Belvedere, Alberta. The latter writes to me: "In 1923, Mr. Richard C. Harlow took at least two and, if I remember rightly, three nests with eggs near Belvedere. I helped him hunt the last of these nests on June 19, 1923, and secured a picture of the nest and eggs. The nest, which contained four eggs, was well concealed at the side of a bunch of dry grass, which overhung the nest, and it was a slight hollow in the ground lined with dry grass, with an inner lining of finer grass. The nest was in the open in rather short grass and weeds, near the edge of poplar woods. The females are very secretive and keep mostly to the ground or near it, and are difficult to observe. Previous to finding this nest, I had started the female from the nest, or close to it, and she crept away along the ground much after the manner of a mouse."

Another nest, found June 25, after Mr. Harlow had left, was on a ridge covered with an open growth of fire-killed poplars, small bushes, and weeds. "It was made of a few leaves on the outside, a few bark strips and vine stems, and was lined with fine fibres and horsehair. It was completely hidden and was attached to rose bush canes 6 inches from the ground."

Mr. Harlow now tells that, up to 1926, he has found 8 nests of the Connecticut warbler, 2 sets of 3 eggs, 5 sets of 4, and 1 set of 5 eggs, all in the vicinity of Belvedere. What he describes in his notes as a typical nest was found in open poplar woods on a ridge above a small slough, surrounded by a growth of willows, into which the female always went when flushed. The nest was at the base of a small, spreading wild rose bush, well under the spreading lower branches, entirely concealed, well sunken in a scratch in the ground, and draped about by fine, dead grass. He describes the nest as much more frail than that of the mourning warbler and made of fine grasses and plant fibres.

According to Dr. Roberts (1936) and several other observers, for which he gives the references, the Connecticut warbler, in Minnesota, always nests in spruce or tamarack bogs, in sphagnum moss or among other northern bog vegetation. One of the best accounts for this region is given by N. L. Huff (1929). He describes a swamp in Aitkin County, northern Minnesota, in which he found this warbler breeding, as follows:

> This swamp is perhaps half or three-quarters of a mile wide and two miles or more in length. Much of its area is covered with a pure stand of a small black spruce, some parts with an equally pure stand of tamarack, but in places these two species are more or less mixed together. The pitcher plant and the sundew thrive here, as do the buckbean and the wild calla, the coral root, the moccasin flower, and that rare and gorgeous orchid, the dragon's mouth (*Arethusa bulbosa*). * * *
>
> The spot chosen for the nesting site was a little opening among the black spruce trees, not more than 30 yards from the margin of the swamp. A luxuriant growth of sphagnum covered the ground everywhere to a depth of several inches. The nest was a rather deep, rounded cup, compact and well made. Inside it measured an inch and a half in depth, and two inches in width. The wall of the nest was approximately half an inch in thickness, and was composed entirely of fine dry grasses, except for a few black plant fibers resembling horse hairs, woven into the lining of the bottom. It was sunken in a mossy mound, the top of the nest being level with the top of the moss. Labrador tea and swamp laurel, low bog shrubs that formed a dense tangle throughout the little opening, overtopped the moss by a foot or more and offered ample protection for the otherwise open nest.

Eggs.—Four or five eggs make up the usual set for the Connecticut warbler. The eight eggs in the Thayer collection in Cambridge are ovate and have a slight gloss. The creamy white ground color is speckled, spotted and blotched with "auburn," "bay," and "chestnut," with underlying spots of "brownish drab," "light vinaceous drab," and "light Quaker drab." They seem, generally, to be more boldly marked than those of the Kentucy warbler. Some eggs are heavily blotched or clouded with "wood brown."

The eggs of one such set are all clouded with large patches of brown, which merge with the undertones of drab, and one egg has the large end entirely covered. The markings tend to be concentrated, but do not form a wreath as often as with the eggs of many other warblers. The measurements of 39 eggs average 19.5 by 14.3 millimeters; the eggs showing the four extremes measure **21.3** by 14.3, 19.9 by **15.6, 17.3** by 14.0, and 18.8 by **13.2** millimeters (Harris).

Young.—We have no information on the incubation of the Connecticut warbler nor on the development and care of the young while in the nest. But Francis Zirrer (MS.) has sent me the following account of the behavior of the young after leaving the nest, as observed near his woodland dwelling near Hayward, Wis.: "A pair breeding nearby in 1942 was hardly ever seen until July 20, when the whole family appeared among the tamaracks in the rear of the dwelling and remained there for nearly 2 weeks, part of the time within sight of our windows. At first the young kept close to the ground, in small tamaracks, other evergreens and bog shrubbery, but most of the time, and apparently preferably, in the piles of treetops and other coniferous slashings of which there are several nearby. There the birds moved in and out, after the manner of wrens. Time and again I saw the old birds feeding young on the top of these slashings and saw the young disappear out of sight again after being fed. A few days later, however, the young birds were moving about freely, coming at times quite close to the dwelling. Although most of the searching for food and feeding the young was done in the tamaracks when they were near the dwelling, the old birds every once in a while would disappear among the dense brambles on the edge of the bog and feed the young, mostly with raspberries, with an occasional green caterpillar.

"On August 2, for the first time, they disappeared entirely out of sight of the windows, but after a short search I found them about 80 yards away. From then on every day I found them farther away, but until August 20 the birds remained within a narrow belt of evergreens. * * * After August 20 the birds had apparently begun to band with others of their kind into larger flocks, for a flock of about 20 to 25 was seen several times."

Plumages.—Kilgore and Breckenridge (1929) give us the only account we have of the juvenal plumage of the Connecticut warbler: "The nestling, which was just passing from the downy to the juvenile plumage and was probably far enough advanced to leave the nest within 2 or 3 days, shows the following characters. Upper parts dark olive-brown, breast and sides snuff-brown merging into buffy-yellow on the belly, legs and feet very light flesh color."

Dr. Dwight (1900) describes the first winter plumage of the male as "above, including wings and tail, brownish olive-green almost exactly like *G. trichas*, but usually greener and grayer. Below, unlike *G. trichas*, being canary-yellow, washed on the sides with pale olive-brown, and with broccoli-brown on the throat often concealing cinereous gray, the chin wood-brown. The orbital ring conspicuously pale buff."

He says that the first nuptial plumage is acquired by a partial prenuptial molt, "involving much of the head and throat, which become clear plumbeous or ashy gray instead of brown, slightly veiled with olive-brown on the pileum and with drab-gray on the throat, the orbital ring white."

A complete postnuptial molt in summer produces the adult winter plumage, which "differs from the first winter dress in being cinereous gray instead of brown on the head and throat, palest on the chin, and slightly veiled with drab-gray on the throat, and olive-green on the crown. The back is greener and the yellow below rather brighter. The orbital ring is white. The birds with deeper plumbeous throats are probably still older. This dress differs but little from the nuptial, a fact not generally known."

The adult nuptial plumage is "acquired perhaps by a partial prenuptial moult as in the young bird or possibly by wear alone."

The female, in first winter plumage, is "browner above and on the throat than the male, but often indistinguishable. The first nuptial is acquired chiefly by wear. The adult winter is similar to the first winter but rather grayer on the throat resembling the male in first winter dress. The adult nuptial and later plumages are never as gray as those of the male."

Food.—Very little seems to be known about the food of the Connecticut warbler. Audubon (1841) observed two "chasing a species of spider which runs nimbly over the water, and which they caught by gliding over it, as a Swallow does when drinking. * * * On opening them I counted upwards of fifty of the spiders mentioned above, but found no appearance of any other food."

Dr. B. H. Warren (1890) says that it "feeds on beetles, larvae, spiders, snails and sometimes on small seeds and berries."

Behavior.—While with us on the fall migration, the Connecticut warbler is not particularly shy, though rather retiring. As we find it in the swampy thickets or in damp meadows among scattered bushes, we may see it walking quietly on the ground, or starting up when disturbed, it stops to perch on some low branch, watching us intently for several seconds before seeking the seclusion of the denser shrubbery. These birds are excessively fat in the fall, so fat in fact that it is difficult to make a good specimen of one. Huff (1929), however, writes:

> In his summer home the Connecticut Warbler is a shy and elusive bird, so secretive in his manner that he would rarely be seen here, even by those looking for him, were it not for his betraying song. * * *
>
> When driven from his song perch by too close approach of his observer he escapes, often unseen, from the opposite side of the tree, and the first indication of his departure may be his jubilant, triumphant song gushing from a tree several yards away. If one is fortunate enough to see him enter another tree nearby, one is impressed with the remarkable facility with which he creeps, half hidden, through the tree until he reaches a secure position, separated from his observer by a limb or a small mass of foliage. More than once as he scampered along a branch, his body low, his head extended, seeking a suitable hiding place, I have seen him pause an inch beyond the coveted spot. With head and shoulders visible he takes a hasty peep at his observer, then suddenly retreats a step or two and adjusts his position until he is wholly obscured. * * *
>
> If one remain perfectly still or in hiding for a while, the singer forgets one's presence and sooner or later will move out of his hiding place, walking along on a limb or occasionally hopping to a nearby branch, taking some tiny insect or other tidbit that meets his fancy, all the while repeating his song several times a minute. His relative inactivity, his rather deliberate movements, now afford an excellent opportunity for observation. * * *
>
> Whether he had forgotten my presence or merely regarded me now as a part of the landscape, I do not know, but he no longer sought to conceal himself. He often sat motionless for several minutes, except for the shaking and quivering of his body which always accompanied his singing.

Mr. Harlow tells me that a female that he watched returned to her nest three times within an hour; she always walked back to the nest.

Voice.—In his first account of the nesting of the Connecticut warbler, Seton (1884) says of its song: "It may be suggested by the syllables, *beecher-beecher-beecher-beecher-beecher-beecher.* It is like the song of the Golden-crowned Thrush, but differs in being in the same pitch throughout, instead of beginning in a whisper and increasing the emphasis and strength with each pair of notes to the last." Later (1891), he recorded another type of song which "nearly resembled the syllables '*Fru-chapple fru-chapple fru-chapple whoit,*' and is uttered in a loud, ringing voice, quite unlike the weak, hurried lisping of the Wood Warblers, which are nesting abundantly in the adjoining dry spruce woods." Mr. Harlow (MS.) refers to its song as heard on the breeding grounds as "very distinctive, *whip-pity*, *whip-pity*, *whip*, clear, ringing, deliberate and resonant, with a definite accent on the first syllable." Various other renderings of the song have been given in syllables, all of which give similar impressions of it, and some of which suggest the song of the Maryland yellowthroat as well as that of the ovenbird. The carrying power of the song is shown by the fact that Mr. Trautman (1940) "heard a male singing more than 300 yards away. Even at that distance the song was readily heard above a brilliant morning bird chorus"

Huff (1929) writes: "The song of the Connecticut Warbler varies with different individuals, and at times with the same individual. The volume may be changed, and certain syllables may be changed or omitted, but the quality of his tone is unique and practically invariable, especially as regards two syllables, '*freecher*,' always included in his song. So characteristic is his voice that one having heard him may identify him more quickly by his song than by sight. His voice is sharp, piercing, penetrating, rather shrill yet pleasing, and is one that I always associate with the wild swampy wilderness where he sings."

This warbler sings nearly as freely on the spring migration as on its breeding grounds. Trautman (1940) says: "More than 80 per cent of all identified birds were singing, and had it not been for the singers the species would have been considered very rare rather than uncommon."

In the fall it is usually silent except for its distinctive call notes. Dr. Chapman (1907) calls this "a sharp, characteristic *peek*." Francis H. Allen writes to me: "I have recorded an autumn note as a sharp chip like the syllable *witch;* that is, it seems to have both a *w* and a *ch* in it. It struck me as a distinctive note." Gerald Thayer wrote to Dr. Chapman (1907) : "The only note I have ever heard from it is a very quick, sharp call, with a clipped-short metallic ring, *plink*, easily remembered and differentiated among warbler chips."

Dr. Tyler and Walter Faxon, two expert and careful observers, were confident that they heard several Connecticut warblers singing on September 25, 1910, in the swamp referred to below. Dr. Tyler has sent me the following account of it: "When we entered the swamp our attention was at once attracted by a bird song which was new to us; it came from the high trees deep in the swamp. My notes, speaking out of this dim past, record that the song suggested to both of us, but rather faintly, that of a parula warbler, but neither of us was satisfied with our provisional diagnosis.

"Later we heard the song repated many times from birds near at hand, and we were impressed again by its novelty, but now by its distinct dissimilarity from the parula's buzzing voice. The notes were far too loud for a parula, too clear and full-voiced, but they had suggested *Compsothlypis* to us because they were given with a sort of rotary effect as opposed to a to-and-fro rhythm.

"The song—clear, ringing, and very loud—was made up of four notes, all strongly emphasized, sounding like *three*, *three*, *three*, *three*, pronounced in two or three syllables each. The pitch ran up the scale slightly, and the quality suggested to both of us the mourning warbler's voice. On this notable morning Connecticut warblers were scattered throughout the swamp, an area of twenty acres or so. We must have seen a dozen, perhaps twice that number, during the two hours we spent there. On one occasion three jumped up from the ground into the same shrub, and time after time from one end of the swamp to the other we started single birds. A few days later we heard the song here again. The Connecticut warblers were still present, but we never actually saw a bird in the act of singing, although once we heard the song from a shrub from which, a moment later, jumped one of the birds. Nevertheless, because of the large number of Connecticut warblers gathered here on these two days, because we could ascribe this song to no other species of bird, and because it fitted well the published descriptions of the bird's song, we had little doubt in our minds that we had heard Connecticut warblers singing during their autumn migration. This was the only time in his life that Mr. Faxon ever heard the song, although we often saw the birds afterwards, and in all the years since I have never heard it again."

Field marks.—The Connecticut is a rather large warbler and rather plainly colored, with no white in the wings and tail, but with a pronounced eye ring, white in the adult and buffy or yellowish in the young. The adult male is olive-green above and yellow below, with a broad, light-gray throat. The female and young are browner. The adult male might be confused with the mourning warbler, but it is larger, has no black on the breast and has a complete and conspicuous eye ring; the latter is the best field mark in any plumage, regardless of age or season.

Fall.—On its return to its winter quarters the Connecticut warbler follows a partially different route from that taken in the spring. From its breeding range in central Canada it migrates almost due east to New England, largely avoiding the Mississippi Valley south of northern Illinois and Ohio, and thence southward along the Atlantic coast through Florida and the West Indies to its winter home in South America.

Mr. Trautman (1940) says of the fall migration in Ohio: "In this migration the species was not recorded as frequently nor in as large numbers as in spring, and seldom more than 3 birds were seen in a day. It is probable that the species was as numerous as it was in spring, since the nonsinging birds appeared in equal numbers in both seasons. In fall this warbler was not confined to dense tangles of remnant swamp forests, but also inhabited brushy, weedy, and fallow fields."

The following note from Dr. Winsor M. Tyler is typical of our experience with this warbler in Massachusetts in the fall: "There used to be a wooded swamp in Lexington, Mass., not unlike the region near Fresh Pond where, in the 1870's, the Cambridge ornithologists often observed the Connecticut warblers. In the Lexington swamp, years later, Walter Faxon and I used to find the birds in the fall, starting them from among the beds of jewel weed which grew profusely there. I spoke of this locality when writing of the veery and of the golden-winged warbler, for both of these birds bred in it commonly every year.

"The Connecticut warbler, as we see it in the fall migration, is a very distinctive bird. It starts up from nearly underfoot and, alighting for a moment at short range, often in full view, jerks about in the shrubbery, peering inquisitively at us, its eye ring giving the odd effect of a man looking over his spectacles with eyebrows raised. If really startled, the bird retires to the high trees where it walks sedately over the branches. Its throat at this season varies from brownish yellow to smoky gray, and a striking character, as we look up at the bird, is the long under tail coverts which come nearly to the tip of the tail."

William Brewster (1906) used to find these warblers very abundant in certain swamps near Cambridge during September, and writes:

> We used to find Connecticut Warblers oftenest among the thickets of clethra, *Andromeda ligustrina*, shad-bush, and black alder, which formed a dense undergrowth beneath the large maples that shaded the wooded islands of this swamp, and in the beds of touch-me-not (*Impatiens*) that covered some of its wetter portions. They were also given to frequenting the banks of the numerous intersecting ditches, especially where the deadly nightshade, clinging to the stems of the bushes, trailed its gray-green foliage and coral-red berries over the black mud or coffee-colored water. In such places they often literally swarmed, but so retiring and elusive were they that by any one unacquainted with their habits they might easily be overlooked. They spent most of their time on the ground under or among the rank vegetation, where they would often remain securely hidden until nearly trodden on.

DISTRIBUTION

Range.—Southern Canada and north-central United States south to central South America.

Breeding range.—The Connecticut warbler breeds **north** to central eastern British Columbia (probably Tupper Creek); central Alberta (Manly, Athabaska, Lac la Nonne, Battle River, probably Grand Prairie, Peace River, and Lac la Biche); and probably central and northeastern Ontario (Moose Factory, Lowbush, Gargantua, Sundridge, and Algonquin Park). **East** to northeastern Ontario (Moose Factory) and northern Michigan (Porcupine Mountains, Huron Mountains, Munising, McMillan, and Bois Blanc Island). **South** to northern Michigan (Bois Blanc Island); northern Wisconsin (Orienta and Wascott); northern Minnesota (Itasca Park, Gull Lake, Aitkin County, Cambridge, and Tower); southern Manitoba (Duck

Mountain, Lake Saint Martin, Carberry, Aweme, Shoal Lake, and Sandilands); and southern Alberta (Glenevis). West to southern Alberta (Glenevis) and central eastern British Columbia (probably Tupper Creek).

Winter range.—The winter range of the Connecticut warbler is known only through specimens from central western Brazil (Alliança and Rio San Lourenço); and probably north to central Venezuela (Cumbre de Valencia and Carabobo).

Migration.—Late dates of spring departure are: Brazil—Tonantins, April 9 and Venezuela—Rancho Grande, near Maracay, Aragua, April 29.

Early dates of spring arrival are: Bahamas (casual)—Cay Lobos Light, May 9. Florida—Stock Island in lower Florida Keys, and Mosquito Inlet, May 9. Georgia—Atlanta, May 5. South Carolina—Chester, May 10. North Carolina—Asheville, May 12. West Virginia—Ritchie County, April 25. District of Columbia—Washington, April 30. Maryland—Baltimore County, May 5. Pennsylvania—Crystal Lake in Crawford County, May 18. New Jersey—Makania Swamp, May 6. New York—Keene, May 15. Massachusetts—Wachusett Mountain, May 10. Louisiana—Monroe, April 27. Arkansas—Monticello and Hot Springs National Park, April 28. Tennessee—Memphis, April 23. Kentucky—Bowling Green, April 21. Missouri—Columbia, May 4. Illinois—Chicago region, May 3 (average May 15). Indiana—Bloomington, April 27. Ohio—Oberlin, May 3; Columbus, May 3 (average for central Ohio, May 12). Michigan—Muskegon County, May 4. Ontario—Guelph, May 9. Iowa—Polk County, Hillsboro, and Wall Lake, May 5. Wisconsin—Ripon, May 10. Minnesota—Minneapolis, May 11 (average of 16 years for southern Minnesota, May 25). Texas—Houston, April 20. North Dakota—Fargo, May 23. Manitoba—Aweme, May 18 (average, May 27). Alberta—Edmonton, May 20.

Late dates of fall departure are: Alberta—Glenevis, September 5. Manitoba—Shoal Lake, September 6; Aweme, September 3 (average, August 30). North Dakota—Fargo, October 1. Texas—Cove, November 5. Minnesota—Minneapolis, September 19. Wisconsin—Madison, October 4. Iowa—Polk County, October 1. Ontario—Point Pelee, October 2. Michigan—Detroit and vicinity, October 8. Ohio—Youngstown, October 16; Columbus area, October 12 (average, October 2). Indiana—Richmond, October 9. Illinois—Chicago region, October 13. Kentucky—Bardstown, October 11. Arkansas—Washington County, October 14. Louisiana—Monroe, October 9 (only fall record). Quebec—Hudson, October 4. Nova Scotia—Sable Island, October 6. Maine—Westbrook, September 20. New Hampshire—Jefferson region, October 6. Vermont—Woodstock, October 2. Massachusetts—Boston, October 29. Rhode Island—Green Hill, October 5. Connecticut—New Haven, October 13. New York—Idlewild, Long Island, November 6; East Hampton, Long Island, November 26. New Jersey—Union County, October 18 (average of 9 years, October 1). Pennsylvania—Jeffersonville, October 16. Maryland—Patuxent Wildlife Research Refuge, October 29; College Park, November 7. District of Columbia—Washington, October 22 (average of 13 years, October 12). West Virginia—Bluefield, October 1. Virginia—Rosslyn, October 24. North Carolina—Raleigh, October 24. Florida—Sombrero Key, October 9.

Early dates of fall arrival are: North Dakota—Cass County, August 16. Texas—Commerce, August 28. Minnesota—Hutchinson and Frontenac, August 29. Wisconsin—New London, August 24. Iowa—Marshalltown, August 22. Ontario—King, August 21. Michigan—Sault Ste. Marie, August 19. Ohio—Waverly, August 10; central Ohio, August 27 (average, September 8). Indiana—Lake County, August 31. Illinois—Glen Ellyn, August 14. Quebec—Hudson, August 18. Maine—Cape Elizabeth, August 30. New Hampshire—Randolph, August 18. Vermont—St. Johnsbury and Wells River, August 21. Massachusetts—Belmont and Martha's Vineyard, August 19. Connecticut—East Hartford and Litchfield, September 1. New York—Frost Valley in southern Catskills, August 16; Alley Pond, Long Island, August 17. New Jersey—Passaic, August 24. Delaware—Delaware City, September 3. Maryland—Patuxent Wildlife Research Refuge, September 9. District of Columbia—Washington, August 28 (average of 21 years, September 21). West Virginia—Bluefield, September 10. Virginia—Rockbridge County, August 31. North Carolina—Raleigh, September 28. Florida—St. Marks, September 21. Bahamas—Nassau, October 12. Costa Rica—San José, October 6. Colombia—Bonda, Santa Marta region, October 22. Venezuela—La Trilla, October 23. Brazil—Aliança, Rio Madeira, November 16.

Egg dates.—Alberta: 8 records, June 15 to 25.

Manitoba: 2 records, June 12 to 21.

Minnesota: 2 records, June 12 and 13 (Harris).

OPORORNIS PHILADELPHIA (Wilson)

MOURNING WARBLER

PLATE 64

HABITS

Alexander Wilson (1832) discovered this warbler "on the border of a marsh, within a few miles of Philadelphia," hence the scientific name *philadelphia*; he called it the mourning warbler on account of the black markings on its breast, which suggested a symbol of mourning. The name is not happily chosen, however, for as Forbush (1929) says, "this crêpe-like marking about the breast is the only thing about the bird that would suggest mourning, for it seems as happy and active as most birds, and its song is a paean of joy." Wilson never saw another specimen, and Audubon handled very few; Nuttall was apparently not sure that he even saw a single one. This is not strange, for it is not common in the Eastern States, where it occurs as a late migrant and is not easily detected in the dense shrubbery that it frequents at a time when vegetation is in full leaf.

Spring.—From its winter home in Central and South America, the mourning warbler enters the United States on a front extending from Florida to Texas; it is apparently very rare in Florida, where Howell (1932) gives only two spring records. There is probably a heavy migration directly across the Gulf of Mexico, from Yucatán to the Gulf States, for M. A. Frazar (1881) saw "large numbers" flying northward on a line from Yucatán to the mouth of the Mississippi, when his ship was about 30 miles south of the Louisiana coast. It has been reported by various observers as migrating regularly through eastern Texas, where I have observed it in the passing waves of migrants. Thence it spreads out northeastward along the Alleghenies, as well as migrating northward through the Mississippi Valley. It is comparatively rare east of the Alleghenies, but decidedly commoner to the west of that range. Milton B. Trautman (1940) says of the spring migration in Ohio:

> In spring the Mourning Warbler inhabited chiefly the dense shrub layer of the remnant swamp forests, and, occasionally, the dense tangles of hilly woodlands. The birds in the upland woods were almost invariably in the wetter sections, such as in the lower third of a ravine. The females and some males were very secretive, remaining in dense shrubbery, except when flying in a skulking manner from one tangle to another, or when scolding for an instant upon some terminal branch in response to much "Screech Owl" whistling. The high-plumaged males, however, seemingly sang each morning, and while singing were most conspicuous. The males usually remained quiet during the early morning warbler chorus. About 7 a. m. their sharp, "chip" note could be heard in tangles, and shortly thereafter they appeared singly and in small groups. They perched on small twigs, peered about for a moment, flew upward a few feet, and alighted upon the twigs of small, rather isolated bushes or saplings. There they perched quietly for a few moments before beginning to sing. After singing in loud clear voices several times they hopped upward to the next branches and repeated the song, and then continued alternately to perch higher and sing until the tops of the shrubs or saplings were reached.

From the fan-shaped migration route the breeding range spreads out from Newfoundland on the east to Alberta on the west, including southern Canada and some of the Northern States, and extends southward in the mountains to New York, Pennsylvania, and West Virginia. On its breeding grounds, the mourning warbler shows a preference for old clearings and cut-over lands or slashings, often on the uplands, where dense thickets of raspberries or tangles of blackberry vines have covered the open ground; it is also partial to patches of nettles and is especially fond of extensive growths of jewelweed and other rank herbage. It seldom ventures far into the shady woods but may be found around the edges, along old brush fences and in lowland thickets, such as are frequented by northern yellowthroats, even where the ground is damp.

Nesting.—The rather bulky nest of the mourning warbler is placed on or near the ground, usually not over 6 inches above it, though sometimes as much as 30. It is generally built in tangles of raspberry, blackberry, or other briery shrubs, sometimes in a bunch of ferns, in a clump of goldenrod or other rank herbage, or even in a tussock of grass. Ora W. Knight (1908) describes a nest found in Maine:

> The nest was quite a bulky affair and placed at the base of a clump of coarse weed stocks about six inches from the ground. The outer nest was of dry leaves and vine stalks. The nest proper was made up with a thick outer wall of dead, coarse, flat-bladed grass, with finer grasses and a few weed stalks, and all through this outer wall was interwoven a few small, dead, white maple leaves. The inner wall was composed of fine grasses, and the inner lining contained a few horsehairs. It was a very neat, compact nest, well built to protect the eggs from dampness from the moist ground where it was placed. It measured, outside diameter, five inches; inside diameter, two inches; outside depth, three and one-half inches; inside depth, two inches.

E. H. Eaton (1914) quotes Verdi Burtch, of Branchport, N. Y., as follows:

> In Potter swamp, where the timber has been well thinned out, where the ground is wet and springy, where the ferns, skunk cabbage, tall rue, spice bush, bishop's cap, false Solomon's seal, white baneberry and marsh marigold mingle, and poison ivy and woody nightshade cover the stumps and dead tops, and here and there a tall dead stub towers above the bushes, here the Mourning warbler makes its summer home, nesting along the abandoned wood roads and more open places that are now grown up with grass, ferns, skunk cabbage, rue and marsh marigolds. * * * These swamp nests are usually situated in a grassy place among the brush and tops that were left by the lumbermen, in a bunch of weeds, or in the middle of a bunch of skunk cabbage or ferns. One nest was placed on top of a thick vine that ran over the ground and there was scarcely any attempt at concealment. Another was in a very wet place in the heart of a marsh marigold. Another was in a bunch of weeds on a rotted moss and dirt-covered log. The nests are usually very well concealed and very near the ground. * * *
>
> The Mourning warbler also nests in an entirely different situation near Branchport. June 4, 1903, a nest was found in a dry bush lot clearing along a large gully at an elevation of 250 feet above the valley. It was placed in a small beech bush 18 inches from the ground among wild blackberry bushes, beech stumps and sprouts. * * * A nest found June 13, 1909, was a little farther up this same hill and was placed on the ground in a clump of oxeye daisies close by the highway through some woods and it was less than 2 feet from the beaten track.

Eggs.—The mourning warbler lays from 3 to 5 eggs to a set, more often 4. They are ovate with a tendency toward short ovate and have a slight gloss. The ground color is white, or creamy white, and is speckled, spotted, or blotched with "bay," "chestnut," and "auburn," with underlying spots of "light vinaceous drab," "brownish drab," or "drab-gray." In addition to these markings, many eggs have a few scattered spots, or very small scrawls of black. Although there is a tendency toward concentration of markings at the large end, many eggs are finely and delicately speckled over the entire surface. The measurements of 50 eggs average 18.2 by 13.8 millimeters; the eggs showing the four extremes measure **20.0** by 14.2, 19.9 by **14.7, 16.5** by 13.7, and 17.7 by **13.2** millimeters (Harris).

Plumages.—Dr. Dwight (1900) says that the juvenal plumage of the mourning warbler is "very similar to *G. trichas* but darker. Above deep olive-brown. Wings darker, edged with olive-green, the coverts faintly edged with pale cinnamon. Tail deep olive-green. Below, very deep grayish tawny-olive, abdomen and crissum pale brownish Naples-yellow. Inconspicuous orbital ring pale buff."

The postjuvenal molt, which involves the contour plumage and the wing coverts, but not the rest of the wings or the tail, occurs in August and is completed before the birds reach their winter home. Dr. Dwight describes the male as "above similar to *G. trichas* and to *G. agilis* but greener than either, with a plumbeous tinge about the head, and the yellow below brighter. There is usually a little concealed black on the throat; the chin is yellowish white. The conspicuous orbital ring and a supraloral line are pale canary-yellow, the lores dusky."

The first nuptial plumage is "acquired by a partial prenuptial moult which involves chiefly the head and throat. The plumbeous cap, the black throat veiled with cinereous, the dusky lores and the white orbital rings are assumed, the rest of the plumage showing a good deal of wear." This and subsequent prenuptial molts occur in late February and March, before the birds come north.

Adults have a complete postnuptial molt in August and a partial prenuptial molt as in the young birds. Of the female, he says: "The plumages and moults correspond to those of the male. In first winter plumage the throat is browner and in but slight contrast to the breast, scarcely distinguishable from the male first winter dress of *G. agilis*. The first nuptial plumage is acquired chiefly by wear. The adult winter plumage resembles the somewhat grayer first winter male." No black is assumed on the throat.

Food.—No one seems to have made a study of the food of this warbler. Dr. B. H. Warren (1890) mentions beetles and spiders in the food of two that he examined. The bird is doubtless mainly insectivorous and probably obtains most of its food on or near the ground. An interesting item of food is mentioned in Dr. Skutch's account of winter habits.

Behavior.—In a general way the behavior of the mourning warbler is much like that of the northern yellowthroat, though it is rather more timid and retiring, plunging into the densest thickets on the slightest alarm. It is especially secretive on the fall migration, skulking through the thickest underbrush on the edges of the woods or along old brush fences. But, in the spring, the males are often quite conspicuous, mounting to the tops of bushes or small trees to sing. William Brewster (1938) writes: "A male among fallen tree-tops behind the house eluded me in the most provoking manner, creeping about like a Wren among the debris. Sometimes he would appear within a few yards of me, disappearing almost instantly, and when next seen would be perhaps forty or fifty yards away. His gait was distinctly a 'hop' but in other respects he resembled the Connecticut Warbler, especially in flight and in attitude when perched."

Voice.—Aretas A. Saunders contributes the following study of the song:

"The song of the mourning warbler is quite short, and averages a little lower in pitch than most warbler songs. It is loud, musical in quality and contains marked explosive and liquid consonant sounds. It is usually in two distinct parts.

"The first part consists of 2 to 5 notes, slurs, or 2-note phrases, sounding, when a single note, like *tleet or tseet*, and when of 2-notes like *tolee* or *choree*, varying in individual birds. The majority of songs have 3 such notes or slurs. Of my 30 records 20 slur upward, 6 slur downward, and 4 are single notes. When they slur downward the sound is like *teelo*. The second part is short, and the notes faster, especially when there are many. The number of notes varies from 1 to 9, averaging 3. In 5 records there is no second part. The notes of the second part vary considerably. In some songs they are all equal and on one pitch, sounding like *to to to* or *tsit tsit*. When there are more notes they vary in pitch and are often connected giving an effect like *totletoleeto*. The second part is two to three tones lower in pitch than the first.

"The pitch varies from C′′′ to B′′′, a half tone less than an octave. Individual songs range from one to three and a half tones, averaging two tones. Songs are from 1 to 2 seconds in length. The notes of the first part occur about three a second; those of the second part about five a second.

"The mourning warbler also sings a flight song which is somewhat longer, contains several *choree* notes, usually at the beginning, and several groups of rapid twitters. The bird rises from the ground or a low perch, singing as it rises, terminates the song at a height of about 20 feet, and drops silently back to the ground.

"My records of 14 years in Allegany State Park, N. Y., show that the song ceases in July, averaging July 14, the earliest date being July 7, 1932 and the latest date July 22, 1935. The song is sometimes revived in August, especially the flight song."

Francis H. Allen (MS.) sets the song down as "*wee surree surree surree surree*, with a falling inflection. Three or four *thur-rees* are often followed by a pretty warble, which I once recorded as *thurréedloo.* Sometimes there are two or three introductory notes, and a bird at Underhill, Vt., used to address my companion with a greeting that sounded much like *kiss me Charrlie*, *Charrlie*, *Charlie.* Birds on the spring migration sang very distinctly *wee-three wee-three wethree.* The song, in my experience, is always distinctive and easily identified. A call or alarm note is a sharp, rough *chip* that seems to be diagnostic."

A. D. Du Bois (MS.) writes the song as "*chooy*, *chooy*, *chooy*, *choo-choo-choo.* The first three notes are alike, beginning at the same pitch, and each slurred upward to the same extent." In some notes sent to me a long time ago, Dr. Harrison F. Lewis records nine different renderings of the song in syllables; six of these are different combinations of *yeee*, *yeee*, *yeee*, *churr*, *churr*, *churr*, varying from two to four of each of the two syllables in the different songs; others are *yeee*, *yeee*, *churry-urry-urry*, and three or four repetitions of the *churry* note. The song reminded him of the songs of the house wren and Lincoln's sparrow. I recorded it in Newfoundland in 1912 as *we zrrée*, *we zrrée*, *we zrrée-u.* Many other similar renderings have been published. Wendell Taber refers in his notes to the persistent singing of a male mourning warbler on its breeding grounds; he counted 49 songs in 12 minutes between 7:30 and 7:42 p. m., the songs being regularly spaced.

Field marks.—The mourning and MacGillivray's warblers are very much alike, but the adult male of the latter has a white spot above and another below the eye, which are lacking in the former. The young male and the female of these two species are almost impossible to distinguish, as the young mourning warbler has an indication of an eye ring, but it has a shorter tail than the MacGillivray's. Fortunately, the ranges of the two do not overlap to any great extent. In some plumages, the mourning warbler resembles the Connecticut warbler, though it is decidedly smaller, and the under tail coverts of the latter are decidedly longer. The adult male mourning is distinguished by its black throat and by the absence of the white eye ring, but females and young males have an incomplete eye ring in the fall, making their recognition difficult.

Enemies.—This warbler is evidently a rare victim of the cowbird; I can find only four records of such parasitism.

Fall.—The autumnal migration route of the mourning warbler is apparently a reversal of the spring route. The bird is an early migrant, leaving its breeding range in July and August, and appearing in Central America early in September. It seems rarer in the fall than it probably is, for it is very secretive, skulking through dense thickets and rank herbage; it is mainly silent, also, which helps to make it seldom observed.

Winter.—Dr. Alexander F. Skutch contributes the following account: "The mourning warbler is an abundant winter resident in the lowlands of Costa Rica, up to an altititude of about 4,000 feet. It is numerous on the lower Caribbean slope, and equally so in the basin of El General on the Pacific slope, where at an elevation of 3,000 feet it is still one of the most abundant of wintering warblers. But in the drier northwestern province of Guanacaste, it is rare or absent. Avoiding the woodlands, it frequents low, dense thickets and fields overgrown with tall weeds and rank grass, where it reveals its presence by its constantly repeated sharp call-note, yet is difficult to glimpse. It is solitary during the winter months.

"During the exceptionally wet year of 1937, a mourning warbler, who lived in a weedy field close by my cabin, sang repeatedly, especially on rainy or darkly overcast and threatening afternoons. I first heard him on February 15, and then at intervals until late in March. As he flitted about through the wet vegetation in search of insects, he would sing a low but full, smoothly flowing, long-continued warble—an exceptionally beautiful song, much like that of the Central American ground-chat. On April 24 of the same year, I heard another mourning warbler sing, but this time only a few detached syllables. This bird then proceeded to eat the protein bodies from the leaf-bases of a young Cecropia tree. These tiny, white, beadlike corpuscles, produced in numbers on the brown, velvety bases of the long petioles of the broad Cecropia leaves, are the special food of the Azteca ants that dwell in the hollow stems of this fast-growing tree. When the tree is occupied by its usual colony of ants, the corpuscles are removed as fast as they ripen; but if the tree chance to remain untenanted, they accumulate and become a dainty food for a variety of small birds.

"Although it passes on migration through northern Central America, the mourning warbler has been rarely recorded there. It arrives in Costa Rica in September, usually late in the month, and remains until the end of April or May, sometimes delaying its departure until the middle of May.

"Early dates of fall arrival in Central America are: Guatemala—Panajachel (Griscom), September 20. Costa Rica—San José (Cherrie), September 1, 1890; Río Sicsola (Carriker), September 24; Basin of El General, September 23, 1936 and October 4, 1942.

"Late dates of spring departure from Central America are: Costa Rica—Boruca (Underwood), April 27; Basin of El General, April 27, 1936, May 1, 1937, May 14, 1939, May 5, 1940, April 24, 1942 and April 29, 1943; San José (Cherrie), April 27, 1890; Jejivalle, April 16, 1941. Honduras—Tela, May 10, 1930. Guatemala—La Carolina (Griscom), May 15."

DISTRIBUTION

Range.—Southern Canada and eastern United States south to northwestern South America.

Breeding range.—The mourning warbler breeds **north** to probably northeastern British Columbia (Fort Nelson and Dawson Creek); central Alberta (Athabaska, Camrose, Nevis; probably: Grand Prairie, Peace River, Egg Lake, and Fort MacMurray); probably central Saskatchewan (Big River, Emma Lake, and Hudson Bay Junction); Manitoba (Duck Mountain, Fairford, and Hillside Beach); central Ontario (Kenora, Lac Seul, Missinaibi, Kapuskasing, and Lake Abitibi); southern Quebec (Mistassini Post, Notre Dame de la Doree, Val Jalbert, Cross Point, and Magdalen Island); and Newfoundland (Nicholsville and probably Lewisporte). **East** to Newfoundland (probably Lewisporte); central Nova Scotia (Wolfville and Halifax); central western and southeastern Maine (Andover, Waterville, and Machias); central New Hampshire (Mount Moosilauke); northwestern and central Massachusetts (Mount Graylock and Princeton); southeastern New York (Kortright and Roxbury); northeastern Pennsylvania (Harvey Lake and Laanna); western Maryland (Backbone Mountain); and eastern West Virginia (Cheat Bridge, Cherry River Glades, Top of Allegheny, and Spruce Knob). **South** to West Virginia (Spruce Knob); northwestern Ohio (Spencer and Toledo); Michigan (Montcalm County and Lansing); northeastern Illinois (La Grange Park); central and eastern Wisconsin (Unity, New London, and Germantown); northwestern and central eastern Minnesota (eastern Polk County, Leech Lake, Gull Lake, and Isanti County); and central northern and northeastern North Dakota (Turtle Mountains, Pembina, and Grand Forks). **West** to central northern North Dakota (Turtle Mountains); southern Alberta (Glenevis); and northeastern British Columbia (Fort Nelson).

The mourning warbler winters **north** to southern Nicaragua (Greytown) and western Venezuela (Encontrados). **East** to western Venezuela (Encontrados); Colombia (Ocana and Bogotá); and Ecuador (Mapoto, Papallacta, and Oyacachi). **South** to Ecuador (Oyacachi). **West** to Ecuador (Oyacachi); Costa Rica (Beruca, Juan Viñas, and Cerro de Santa María); and Nicaragua (Greytown).

Migration.—Late dates of spring departure are: Venezuela—Rancho Grande near Maracay, Aragua, April 9. Colombia—Santa Marta region, April 11. Panamá—Gatún, April 28. Costa Rica—San Isidro del General, May 8. Salvador—Lake Chanmica, May 14. Honduras—near Tela, May 10. Guatemala—La Carolina, May 15. Tabasco—Reforma, May 22; Veracruz—Buena Vista, May 13.

Early dates of spring arrival are: Puerto Rico—Santa Isabel, March 21. Florida—St. Augustine, March 13. Virginia—Lexington, April 27. West Virginia—Cabell County, May 7. District of Columbia—Washington, May 4 (average of 16 years, May 15). Maryland—Elk River, May 7. Pennsylvania—Carlisle, May 3; Berwyn, May 5. New Jersey—Bernardsville, May 5. New York—Buffalo and Syracuse, May 2; Hempstead, Long Island, May 8. Connecticut—Glastonbury, May 6. Rhode Island—Cranston, May 21. Massachusetts—Manchester, May 11. Vermont—Wells River, May 10. New Hampshire—East Westmoreland, May 8. Maine—Winthrop and Big Lyford, May 10. Quebec—Montreal, May 20. Nova Scotia—Antigonish, May 30. Newfoundland—Gander, June 7. Gulf of Mexico—30 miles south of mouth of Mississippi River, April 2. Louisiana—Oak Grove, April 18. Mississippi—Edwards, April 28. Arkansas—Helena, May 2. Tennessee—Memphis, May 5. Missouri—Columbia, April 30. Kentucky—Bowling Green, April 20. Ohio—Columbus area, May 1 (average, May 12). Indiana—Terre Haute, May 2. Michigan—Ann Arbor, May 5. Ontario—Ottawa, May 10 (average of 8 years, May 24). Illinois—Chicago region, May 8 (average, May 16). Wisconsin—Dane County, May 3. Iowa—Sac County, May 4. Minnesota—Minneapolis, May 8 (average of 24 years for southern Minnesota, May 18). Texas—Rockport, April 31; San Antonio and Kemah, April 24. Oklahoma—Copan, May 16. Kansas—Lawrence, May 12. Nebraska—Plattsmouth, May 6. South Dakota—Mellette, May 14. North Dakota—Lower Souris Refuge, Upham, May 13; Cass County, May 22 (average May 25). Manitoba—Margaret, May 13; Aweme, May 20 (average June 3). Saskatchewan—Lake Johnston, May 25. Alberta—Glenevis, May 24.

Late dates of fall departure are: Alberta—Glenevis, September 2. Manitoba—Treesbank, September 25; Aweme, September 5 (average, August 29). North Dakota—Fargo, September 21; Cass County, September 18 (average, September 13). Nebraska—Hastings, October 8. Kansas—Washington Creek and Lawrence, September 14. Oklahoma—Norman and Oklahoma City, October 6. Texas—Harlingen, October 27. Minnesota—Minneapolis, October 5 (average of 5 years, September 20). Iowa—Osage, September 12. Wisconsin—Madison area, October 5. Illinois—Chicago region, September 29. Ontario—Ottawa, August 28; Port Dover, September 2. Michigan—Ottawa County, September 27. Indiana—Whiting and Richmond, September 19. Ohio—central Ohio, November 1 (average, September 30). Kentucky—Bowling Green, October 2. Louisiana—Baton Rouge region, October 18. Newfoundland—Cape Anguille, September 24. Quebec—Bird Rock, Magdalen Islands, September 7. Maine—Monhegan Island, October 21. New Hampshire—Monroe, September 21. Vermont—Wells River, September 21. Massachusetts—Nauset, October 1. Connecticut—West Hartford, October 7. New York—Rye, October 12. New Jersey—Union County, October 7. Pennsylvania—Jeffersonville, October 7. Maryland—Patuxent Wildlife Research Refuge, October 13. District of Columbia—Washington, October 1. Virginia—Charlottesville, October 4. North Carolina—Asheville, October 4. Florida—Chokoloskee, September 30. Mexico—Tamaulipas—Guiaves, September 22.

Early dates of fall arrival are: North Dakota—Fargo, August 17; Cass County, August 22 (average, August 30). Nebraska—Red Cloud, August 23. Kansas—Lake Quivira, Johnson County, August 31. Oklahoma—Pittsburg County, August 23. Texas—Austin region, August 17; Brownsville, August 28. Minnesota—Minneapolis, July 31 (average of 11 years, August 22). Iowa—Osage, August 24. Wisconsin—near Neillsville, August 7. Illinois—Glen Ellyn, August 17. Michigan—Sand Point, Huron County, August 17. Indiana—Lake County, September 3. Ohio—South Webster, August 7; central Ohio, August 23 (average, September 5). Kentucky—Bowling Green, September 19. Tennessee—Quebec, August 18. Mississippi—Edwards and Bolivar Counties, September 1. Maine—Muscongus Bay, July 20. New Hampshire—Monroe, August 29. Vermont—Northfield, July 22. Massachusetts—Swampscott, July 20; Northampton, August 9. Connecticut—Hartford and East Windsor Hill, September 7. New York—Bronx, August 5. New Jersey—Englewood region, August 21. Pennsylvania—Pittsburgh, August 14. Maryland—Laurel, August 17. District of Columbia—Washington, August 21. Virginia—Rosslyn, August 19. North Carolina— Montreat, July 31; Asheville, August 23. Tamaulipas—Matamoros, August 16. Guatemala—Panajachel, September 20. Salvador—Divisadero, September 29. Nicaragua—near Bluefields, October 8. Costa Rica—San José, September 1. Panamá—Almirante, October 12. Colombia—Cauca Valley, October 11.

Egg dates.—New York: 44 records, May 24 to July 3; 24 records, June 3 to 20, indicating the height of the season (Harris).

Quebec: 10 records, June 9 to 20.

OPORORNIS TOLMIEI TOLMIEI (Townsend)

NORTHERN MacGILLIVRAY'S WARBLER

Plate 65

HABITS

Westerners seem to prefer to call this bird the Tolmie warbler, a most appropriate name, on which W. L. Dawson (1923) makes the following pertinent comment:

> J. K. Townsend discovered the bird and really published it first, saying, "I dedicate the species to my friend, W. T. Tolmie, Esq., of Fort Vancouver." Audubon, being entrusted with Townsend's specimens, but disregarding the owner's prior rights, published the bird independently, and tardily, as it happened, as *Sylvia macgillivrayi*, by which specific name it was long known to ornithologists. Macgillivray was a Scotch naturalist who never saw America, but Tolmie was at that time a surgeon and later a factor of "the Honorable the Hudson Bay Company," and he clearly deserves remembrance at our hands for friendly hospitality and cooperation which he invariably extended to men of science."

This pretty warbler closely resembles the eastern mourning warbler in general appearance; it frequents similar haunts and is much like it in all its habits. Its breeding range covers a large part of western North America from southeastern Alaska to central California and New Mexico, including the Rocky Mountains and their foothills. Over most of this region it seems to be more abundant than is the mourning warbler in the East.

Samuel F. Rathbun, of Seattle, Wash., says in his notes that MacGillivray's is "a rather common warbler throughout the region, but of unusual distribution. It is partial to localities more or less covered with new growth, particularly if this happens to be scattered among a confusion of dead and fallen trees, through which a fire has swept at some little time previously, and over which nature is beginning to throw a covering of young growth, this having a somewhat open exposure. If such spots are contiguous to low ground, they seem more apt to be frequented by this warbler; but at times it will be found in dry sections of this same rough nature."

In Montana, according to Aretas A. Saunders (1921), it is "a common summer resident of the western half of the state, ranging east to the easternmost mountains, and occurring occasionally in migrations to the more eastern parts of the state. Breeds in the Transition zone in clumps of willow and alder, wild rose or other shrubs, mainly in moist situations along the foothills or lower mountain canyons."

Gabrielson and Jewett (1940) say: "In western Oregon, it frequents the blackberry patches and dense thickets of *Spiraea* or *Salal*, and in the eastern part of the State, it is equally at home in the dense growth of willow about the springs and along the stream bottoms."

Dawson (1923) says of its California haunts: "Brushy hillsides not too remote from water, or dense shrubbery partially shaded by trees, afford ideal cover for this handsome warbler and his all but invisible spouse. Mere chaparral will not do either, for the bird loves moisture, and a certain tang in the atmosphere, found in California in the humid coastal counties and on the middle levels of the northern Sierras. Variety, also, is his delight; and after temperature, variety in cover seems to be the bird's requirement; and a great confusion of shrubs, willow, alder, ceanothus, chokecherry, serviceberry, chinquapin, or mountain mahogany suits him best."

Mrs. Amelia S. Allen writes to me: "About 500 feet beyond our house in Strawberry Canyon in Berkeley, Calif., there is a little draw, running down an oak-covered north slope, in which are many thimbleberries, trilliums, ferns, and brakes. It is occupied each summer by a pair of Tolmie warblers, and I hear their notes from my bedroom window. I always expect to hear it on the seventh of April. In 1940, it was singing on April 2, and I have a few firsts on the fourth, sixth, and eighth. A walk up the canyon the second week of April usually shows four or five singing males, each one in its regular location year after year."

Nesting.—Rathbun has sent me his notes on several nests of MacGillivray's warbler found near Seattle, Wash., all of which were built in salal bushes at heights varying from 2 to 3 feet above the ground. One was "on a somewhat open side-hill not far from an old path. It was very much concealed, and found only by carefully examining each bit of growth thoroughly." Another was "near an old path running through a somewhat open spot in a forest, overgrown with salal shrubs, the ground being littered with old logs above which many of these shrubs thrust their tops"; it was quite plainly seen as he stood on one of the logs. He describes a third as follows: "The location of this nest was in a small clearing on a rather open hillside with scattered second growth, mostly of small firs, with stunted salal shrubs growing about. In one of these latter the nest was built about a foot above the ground and quite plainly to be seen, having the appearance of an old nest, apparently because it was so carelessly constructed. It was outwardly composed of dry weed-stalks, next to which were finer weed-stalks and straws; the lining was of soft dry grasses, fine rootlets, and a few horsehairs. On the top of the nest, effectually concealing the eggs from view, was placed a dead salal leaf, its point and the end of its stem being lightly caught just under the inside edge of the nest, this being, in our opinion, done by the bird with the intent of concealing the eggs on account of the exposure of the nest; it could not have fallen and assumed any such position."

He refers to another nest in which some fine twigs were used. He gives the measurements of two nests in inches; the outside diameters, respectively, were 5½ and 4½, outside height 2¼ and 3, inside diameter 2½ and 2, and inside depth 1⅛ and 1½. Three other nests were in *Spiraea* bushes, and one was in a little fir.

A. D. Du Bois has sent me the data for three nests found in Flathead County, Mont.; one of these was 2 feet from the ground in a yew bush at the side of a tie-hauling road, in the edge of some woods at the base of a foothill; another was 4½ feet from the ground in a balsam fir sapling at the side of a trail.

J. Stuart Rowley writes to me: "On June 16, 1938, while trout fishing along Mammoth Creek, Mono County, Calif., I found two nests of this warbler located in the same general situation and each contained four fresh eggs. The nests were well concealed in thick shrubs along the wet creek bottom and were placed about a foot from the ground. Both females scolded when flushed from the eggs, whereupon the respective males immediately joined in the chirping. It is my firm belief that one will find more warbler eggs while trout fishing than while actually looking for nests."

In the Yosemite region, Miss Margaret W. Wythe (1916) found a nest of the Tolmie warbler, nine inches above the ground in a clump of blossoming chokecherry.

> The structure was placed between four stalks of the chokecherry, and was supported below by several short twigs growing from the root stock. The materials were not woven around the four upright stalks, although several grass blades passed behind one of them. Materials of which the nest was composed were fine dry grass blades and stems, and several shreds of bark about three-eighths of an inch wide. These latter were woven into the outer part of the structure, where a single oak leaf also lay embedded, whether purposely or by accident, I cannot say. The lining was of fine grasses and a few black horsehairs. Some loose grass arched over the top, attached to the nest a little on one side. Later on the two openings thus made by these arching grasses made a sort of entrance and exit, the bird invariably entering on one side and leaving on the other.

Although, most of the nests of MacGillivray's warbler are placed near the ground, some of them practically on the ground, a few have been found from 3 to 5 feet up in bushes, scrub oaks and alders.

Eggs.—MacGillivray's warbler lays from 3 to 5 eggs in a set, most often 4 and very rarely 6. The eggs are ovate and slightly glossy. The white, or creamy white, ground color is speckled, spotted or blotched with "auburn," "chestnut," "bay," or "cinnamon," with spots or undertones of "light brownish drab," "pale vinaceous-drab," or "Quaker drab." Some eggs are delicately marked, while others may be clouded. On many, even the delicately marked types, are often scattered a few spots, or small scrawls, of very dark brown or even black. Occasionally, these scattered dark spots or scrawls are the only apparent markings, the lighter browns lacking and the undertones almost imperceptible. While the markings are generally concentrated at the large end, there is not as great a tendency to form a wreath as in many of the warblers' eggs. The measurements of 50 eggs average 17.8 by 13.6 millimeters; the eggs showing the four extremes measure **19.4** by **15.1,** and **16.4** by **12.7** millimeters (Harris).

Young.—The nest watched by Miss Wythe (1916) held four eggs on June 13, on which the female had been incubating for an unknown period; on the twenty-third two of the eggs had hatched, and the third egg hatched the following day; the incubation period was, therefore, at least ten days. When first hatched, the nestlings had "scarcely a trace of down on them." One the following day, they "were now scantily covered with down, a patch showing on top of the head, a line down the middle of the back, and a tuft on the wings. * * * On June 27 I spent an hour during the morning timing the feeding of the three young birds, from a point about twelve feet distant. I found that the female warbler came with food at intervals of from three to five minutes throughout the hour. On the fourth day after hatching, "juvenal feathers had appeared over most of the head, down the center of the back, and on the wings. The eyes of one bird were open. On the following day the eyes of the second bird were open. * * * The sixth day showed juvenal feathers appearing on the lateral tracts, and tail feathers just beginning to grow out. On the seventh day, June 30, the wing feathers had broken through the sheaths for about one-half an inch. The birds' heads were well covered with feathers, but the sheaths still adhered to the bases. The contour feathers were in a similar condition. The tail feathers did not show any further development. On July 2, the ninth day after hatching, the two older birds left the nest, followed later the same day by the third bird, the latter having been in the nest only eight days.

Based on the findings at four nests, Grinnell and Storer (1924) state that "eggs are laid on successive days, incubation begins immediately upon the laying of the last egg or possibly before, and is completed in 13 days, the young hatch on the same day, or on two successive days, and leave the nest 8 or 9 days after hatching. The male seems to participate but little in caring for the brood."

Plumages.—The molts and plumages of MacGillivray's warbler parallel those of the mourning warbler and need not be repeated here. In the juvenal plumages the two species are practically indistinguishable, except that the former has a longer tail. The differences in later plumages are referred to under field marks. Dickey and van Rossem

(1938) have this to say about the prenuptial molt: "In February and March there is a body molt, apparently much more extensive in the young than in adults. The former at this time take on the bluish head and chest of maturity. There is some individual variation, but in general it may be said that the extreme richness of coloration is not attained until the second year. The spring plumage of older birds is the result of a limited renewal plus the wearing away of the paler colored tips of the fall plumage. It takes place in February and March at the same time as that of the younger birds."

Food.—Mrs. Bailey (1928) lists in the food of this warbler "insects, including the click beetle, dung beetle, flea beetle, caterpillars, and the alfalfa weevil." No comprehensive study of its food seems to have been made.

Behavior.—MacGillivray's is the same timid, shy, and elusive little bird as its eastern counterpart, the mourning warbler. Gabrielson and Jewett (1940) write: "The birds are much in evidence in their chosen haunts in late April and early May while the courtship is in progress, but when household cares occupy the daylight hours they become as elusive as field mice, slipping about through the thickets like shadows, only the sharp alarm note betraying their presence to an intruder."

Voice.—Rathbun says in his notes: "Its song begins with three or four quickly given notes on nearly the same key, followed by several on a lower key, but this may be varied at times. It is a quite distinctive song and when once learned is not easily forgotten. Throughout there seems to be a minor key; the song lacks smoothness and when heard at a distance has somewhat of a roughness; but, like so many of the songs of birds, it is heard at its best when one is close to the singer. Should its chosen territory be infringed upon, the intruder becomes aware of its presence by hearing a rapid, harsh alarm note, which may be repeated many times." Du Bois tells me that the song of MacGillivray's warbler "resembles the syllables *te-te-te-te-cheweet-cheweet-cheweet*, the first part being about a note higher than the latter part. It is uttered rapidly, the whole song requiring about a second and a half. Sometimes there are only three *te's*, followed by four *cheweet's*."

Mrs. Amelia S. Allen writes to me: "The song of the Tolmie warbler is more musical than most warbler songs. The first half of the song is composed of double notes with a rising inflection; the second half with a falling inflection: *Swee-eét*, *swee-eét*, *swee-eét*, *peáchy*, *peáchy*, *peáchy*. But I hear also: *Peáchy*, *peáchy*, *peáchy*, *twit twit twit*, the first half with a falling inflection." Grinnell and Storer (1924) write:

> At Hazel Green, on May 14, 1919, a bird was observed fully 50 feet above the ground on one of the lower branches of a large incense cedar. * * * This bird sang ten times in two minutes, changing position usually after singing twice on one perch. The song was rendered by the observer *sizik, sizik, sizik, lipik, lipik,*

little change being detected in successive songs. In the first three "words" the "z" sounds were strong, whereas the last two were more liquid. In singing, the bird would throw its head back, and put much bodily effort into the process of utterance. Soon the bird dropped close to the ground and sang from within the shrubbery, changing his position frequently. The sharp *tsip* of the female was heard at this time. After a few songs the male flew up to a perch 30 feet above the ground, sang twice, and then went below again. * * * Other individuals studied and timed while they sang gave their songs at intervals of 10 to 14 seconds. Song production is not continuous, however. * * *

The "z" sounds heard from the bird at Hazel Green are entirely lacking in other songs studied. Two of these clearer utterances we wrote as follows: *syr-pit, syr-pít, syr-pít, syr-sip-sip-sip-sip* (J.G.), and another *cheek-a, cheek-a, cheek-a, cheek-a, chee-e-e-e* (T.I.S.). The first syllables are loud, clear, and set off from one another, while the shorter ones (*sip*) are given rapidly, faster than a person can pronounce them, and sometimes are run almost into a trill.

Field marks.—MacGillivray's warbler is quite unlike any other western warbler. Its dark gray head, neck, and upper breast, the latter almost black, its olive-green back and its bright yellow under parts are distinctive in the adult male. The female and young are similarly marked, but the gray is much paler, sometimes grayish white. Where its range approaches that of the mourning warbler, the two white spots above and below the eye of the adult male will distinguish it. The young bird is less easily recognized, but in all plumages the tail of the western species is the longer.

Enemies.—This warbler is seldom bothered by the cowbird; I can find only four published records of such parasitism.

Winter.—Dr. Alexander F. Skutch contributes the following: "MacGillivray's warbler is an abundant winter resident over the whole highland area of Guatemala, from 10,000 feet down to at least 2,000 feet on the Pacific slope. Avoiding the forest, it lurks near or on the ground on bushy mountainsides and in low, dense thickets—just such habitats as, at lower altitudes in Costa Rica, are chosen by the closely similar mourning warbler. So well do these birds remain concealed, as they forage screened by the foliage, that the bird-watcher must learn to recognize their distinctive, sharp *tuc, tuc* in order to gain a just motion of their abundance; were he to rely upon sight alone, he would call them everywhere rare. Like nearly all birds of similar habits, they live in solitude rather than in flocks.

"MacGillivray's warbler arrives in Guatemala during the second half of September, and departs early in May. On the Sierra de Tecpán, they were much more in evidence at the end of April than they had been earlier in the year, suggesting that the population of wintering birds had been augmented by transients from farther south, for the species winters southward to Colombia. In Costa Rica they appear to be very rare, in sharp contrast to their abundance farther northward.

"Early dates of fall arrival in Central America are: Guatemala—passim (Griscom), September 23; Sierra de Tecpán, September 26, 1933; Huehuetenango, September 19, 1934; Colomba, September 24, 1934. Costa Rica—San José (Underwood), September 25, 1898.

"Late dates of spring departure from Central America are: Guatemala—passim (Griscom), April 26; Sierra de Tecpán, May 10, 1933."

In El Salvador, Dickey and van Rossem (1938) record MacGillivray's warbler as a—

> common midwinter visitant and spring migrant to the upper foothills and mountains, from 2,300 feet on the Arid Lower Tropical Zone to 8,000 feet in the Humid Upper Tropical. * * * MacGillivray's warblers did not arrive until much later than *O. philadelphia*, but after the first week of December they were to be found everywhere in underbrush in the higher foothills and mountains. On Mt. Cacaguatique they were noted in ravine growth along watercourses; on Volcán de Conchagua among the pines in company with black-throated green warblers; on Volcán de San Miguel in the head-high grass of the lava gullies; and on Los Esesmiles in clearings and in natural open spaces in the cloud forest. A fairly cool temperature rather than any particular plant association seems to be the primary factor governing their choice of winter quarters.

DISTRIBUTION

Range.—Southern Alaska, western Canada, and the United States south to northwestern South America.

Breeding range.—MacGillivray's warbler breeds **north** to southern Alaska (Port Snettisham); central Alberta (probably Peace River Landing, Lesser Slave Lake, and Edmonton); and southwestern Saskatchewan (Cypress Hills). **East** to southwestern Saskatchewan (Cypress Hills); southwestern South Dakota (Black Hills); and through the mountains of central Colorado to New Mexico (Alto and Arroyo Hondo Canyon). **South** to southeastern New Mexico (Alto); central Arizona (San Francisco Mountains and White Mountains); northern and central Nevada (Galena Creek, Toyabe Mountains, and Baker Creek); and central California (Paicines, Placerville, Yosemite, Sequoia National Park, Kern River, White Mountains, and Berkeley). **West** to central California (Berkeley); northeastern Oregon (Powder River Mountains); northwestern and central British Columbia (Telegraph Creek, Doch-da-on Creek, Hazelton, Summit Lake, and Yellowstone Lake); and southern Alaska (Boca de Quadra, Bradfield Canal, and Port Snettisham).

Winter range.—The species winters **north** to southern Baja California (La Paz, El Triunfc, and Cabo San Lucas); southern Sonora (rarely Alamos); and Nuevo León (rarely Monterrey). **East** to Nuevo León (Monterrey); Guatemala (Lake Atitlán, Cobán, Patulul, and Dueñas); Costa Rica (San José, Barranca, Buenos Aires); Panamá (Volcán de Chiriquí and Colón); and northern Colombia (Antioquia, Santa Elena, and Bogotá). **South** to Colombia (Bogotá); El

Salvador (Volcán de San Miguel, Volcán de Conchagua, and Volcán de Santa Ana); and Oaxaca (Tehuantepec). **West** to Oaxaca (Tehuantepec); Michoacán (Patambán and Zamora); Colima; Sinaloa (Mazatlán and Escuinapa); and southern Baja California (La Paz).

Casual in northeastern British Columbia (Lower Liard Crossing); southwestern Manitoba (Aweme); southwestern North Dakota (Buffalo Springs Lake); eastern South Dakota (Aberdeen); Nebraska (Stapleton, North Platte, and Hastings); Kansas (Blue Rapids); and northwestern Texas (Gainesville).

The range as outlined is for the entire species, of which two subspecies are recognized. The northern MacGillivray's warbler (*Oporornis tolmiei tolmiei*) is found from southern Alaska, British Columbia, north-central Alberta, southwestern Saskatchewan, and southwestern South Dakota south to southern Baja California, throughout Mexico (except the Yucatán Peninsula), Guatemala, El Salvador, Costa Rica, Panamá, and northern Colombia; the southern MacGillivray's warbler (*Oporornis tolmiei monticola*) is found from northeastern California, southern Oregon, southern Idaho, southern Wyoming, northern and central Nevada, central Arizona, and through central Colorado to south-central New Mexico south to Colima, Michoacán, Morelos and Guatemala.

Migration.—Late dates of spring departure are: El Salvador—Volcán de Santa Ana, May 15. Guatemala—above Tecpán, May 10. Tamaulipas—Gómez Farías region, May 3. Sonora—Rancho la Arizona, May 22.

Early dates of spring arrival are: Sonora—Chinobampo, March 7. Texas—El Paso, April 21; Los Fresnos, Cameron County, May 4. Oklahoma—Cheyenne, May 13. Nebraska—North Platte and Hastings, May 7. North Dakota—Wilton, May 22. Saskatchewan—Wiseton and Conquest, May 25. New Mexico—Fort Bayard, April 1. Arizona—Tucson, March 23. Colorado—Denver, May 1. Utah—Pine Valley, Washington County, May 11. Wyoming—Torrington, May 7. Idaho—Meridian, May 5. Montana—Fortine, May 11. Alberta—Onoway and Waterton Lakes Park, May 25. California—Berkeley, April 2 (average for 18 years in San Francisco Bay region, April 13). Nevada—Pioche, May 12. Oregon—Salem, April 17. Washington—Shelton, April 15; Walla Walla, April 28. British Columbia—Courtenay, Vancouver Island, April 14. Alaska—Wrangell, June 9.

Late dates of fall departure are: Alaska—Point Barrow, September 12. British Columbia—Okanagan Landing, October 2. Washington—Kamiak Butte, Whitman County, September 27. Oregon—Eugene area, November 2; Multnomah County, October 12. Nevada—south end of Belted Range, Nye County, September 28. California—San Francisco Bay region, November 27; Los Angeles, October 24. Montana—Fortine, September 11. Idaho—Moscow area, September

30. Wyoming—Laramie, October 15 (average of 7 years, September 17). Utah—Boxelder County, September 19. Colorado—Weldon, October 20. Arizona—Keams Canyon, October 12. New Mexico—Apache, October 12. Saskatchewan—Last Mountain Lake, August 25. Manitoba—Aweme, September 9. Oklahoma—Cimarron County, September 24. Texas—El Paso, October 8. Mexico—Sonora, Cajon Bonito Creek, September 28.

Early dates of fall arrival are: Utah—Salt Lake City, August 10. Arizona—Tucson, August 6. New Mexico—Apache, August 3. Oklahoma—Cimarron County, August 16. Texas—El Paso County, August 21. Mexico—Sonora, Cerro Gallardo, August 14. Guatemala—Dueñas, September 17. Costa Rica—San José, September 25.

Egg dates.—California: 39 records, May 2 to July 7; 21 records, June 2 to 20, indicating the height of the season.

Washington: 42 records, May 29 to June 22; 23 records, June 1 to 10 (Harris).

OPORORNIS TOLMIEI MONTICOLA Phillips

SOUTHERN MacGILLIVRAY'S WARBLER

This race was named by Dr. Allan R. Phillips (1947) and described as having the tail the "relatively longest" of the species; the "color dull, differing from *O. t. tolmiei* in darker and grayer (less yellowish) green upper parts and paler and greener (less orange) yellow under parts. The difference in color of the under parts is less constant in fall females of unknown age, perhaps due to variation with age and to erroneous sexing of some young birds."

He says that it breeds "in dense deciduous brush of the Canadian Zone from southeastern Oregon (Steens and Mahogany Mts.) and southwestern Wyoming (Ft. Bridger and Steamboat Mt.) south to central Arizona (White and San Francisco Mts.) and central New Mexico (Alto)."

It evidently winters in Mexico and Guatemala.

GEOTHLYPSIS TRICHAS BRACHIDACTYLA (Swainson)

GEOTHLYPIS TRICHAS TRICHAS (Linnaeus)

NORTHERN AND MARYLAND YELLOWTHROATS

Contributed by Alfred Otto Gross

Plates 66–68

HABITS

While the following account applies primarily to the northern yellowthroat *Geothlypsis trichas brachidactyla*, for practical reasons it also includes the Maryland yellowthroat *Geothlypsis trichas trichas*, as the breeding and winter ranges overlap and the literature pertaining to these two forms is so intermixed that they are not easily separated.

The species of *Geothlypis* respond more readily to the influences of the environment than do other American warblers. As a result 12 subspecies of *trichas* have been recognized by the 1931 A. O. U. Check-List and subsequent supplements. Of these, 4, *trichas*, *brachidactyla*, *ignota*, and *typhicola* are in eastern United States and the other 8, *occidentalis*, *campicola*, *sinuosa*, *chryseola*, *scirpicola*, *arizela*, *insperata*, and *modesta* are represented in the western part of the country.

The color pattern of the 12 subspecies is similar; and they vary chiefly in minor differences of size and intensity of color. In a number of instances, the great individual variation which characterizes these birds so obscures their subspecific differences that determination of skins is often difficult and positive identification in the field, especially where the ranges overlap, is impossible.

Of the two forms included in this life history, the northern yellowthroat differs from the Maryland yellowthroat, in the male, in its larger size, and by reason of its more greenish upper surface, more whitish frontal band of grays, more extensively yellow posterior parts, and its usually brownish flanks. The female of the northern is similar to the Maryland but is larger, more greenish above, and slightly paler.

The breeding range of the northern yellowthroat extends from Newfoundland, Labrador and Quebec south to New Jersey, northern Pennsylvania and West Virginia, while that of the Maryland extends from southern Pennsylvania south to eastern Texas and northern parts of Georgia and Alabama.

Throughout most of its breeding range the yellowthroat ranks as one of the abundant warblers. Because of the striking and easily recognized plumage of the male, especially the bright yellow throat and contrasting black mask, and its characteristic syllabic and easily memorized song it is one of our best-known birds. The modestly colored female is more difficult to identify, as it may be confused, by the beginner, with other similarly colored warblers. The yellowthroat seldom visits the habitation of man; it prefers wild lands, especially those grown up with briers and low brush. Its favorite nesting haunts are in the tangled vegetation of brook-sides or margins of swamp woodlands or among the grass and sedges of the marshes, where it frequently shares the company of such birds as the swamp sparrow and the marsh wrens.

When invading its haunts one is impressed with the vigorous personality of the male. He nervously raises his alarm with a variety of scolding, interrogative chirps and chattering notes and his dark inquisitive eyes sparkle with excitement through the black masks.

He darts with nervous animation from place to place, then disappears in the dense cover only to appear again to denounce the intrusion. He displays many wrenlike characteristics, suggesting to Bartram the name olive-colored wren.

Although seemingly secretive and shy, they are unsuspecting and will often allow an approach to within a few feet of them. When finally convinced that no harm is meant, the male may even pour out his song from an elevated perch above his retreat, well-exposed to view. At times he will sing as he proceeds with his serious search for insects among the grass and shrubs.

Spring.—It is impossible to separate the records on the migration of the subspecies of the yellowthroat occurring on the Atlantic coast. The earliest spring migrants appearing in Florida are said to be the Florida yellowthroat (*ignota*) whereas the northern (*brachidactyla*) follows at later dates. The earliest records for North Carolina have been reported as the Maryland yellowthroat (*trichas*). The matter is further complicated by the fact that southern representatives of the yellowthroat are almost non-migratory, being more or less permanent residents in Florida, whereas the northern yellowthroats which breed as far north as Newfoundland and Labrador pass over southern United States, going directly over the home of their southern relatives to spend the winter in the West Indies.

The earliest dates of its appearance at the Florida lighthouses occur during the first week in March, the numbers increase during April, and it is one of the few warblers that are common migrants in southern Florida during the month of May. The migration of the yellowthroat is thus one of the most extended.

The first yellowthroats arrive in North Carolina during the last week of March, by the middle of April they arrive in New Jersey and Maryland, and late in April they are in New York state. The first arrivals appear in southern New England during the first week of May, and the vanguard of northern yellowthroats can be expected in Maine before the middle of the month, although the bulk of the birds do not appear until a week or so later. They reach the northern limits of their nesting range in Newfoundland by the last week of May.

The subspecies *brachidactyla*, according to H. C. Oberholser (1938), is a winter resident in Louisiana from October 8 to April 1. Records, presumably of the northern yellowthroat, reach Arkansas and Kentucky about the middle of April, and St. Louis, Mo., a few days later. They arrive in Ohio during the last week of April, Minnesota the first week of May, and by the middle of the month they are on their breeding grounds in North Dakota and Ontario. The progress of the birds on the Atlantic and Mississippi flyways during the spring migration is at approximately the same rate.

Nesting.—Unlike many of our warblers, the yellowthroat does not nest in the interior of our dense forests and is seldom seen in the upper branches of tall trees, being more or less restricted to low growths of vegetation. However, it is not strictly terrestrial in its habits, as in the ovenbird. It is partial to wet situations but these need not be great in extent. While it may be found on the borders of large marshes and especially on little islands in marshes and swamps it is also met with near springs and small brooks. An extreme wet situation for a nesting site of the Maryland yellowthroat is described by W. I. Whitehill (1897) as follows: "While collecting in a large slough in Jackson County, Minnesota, on June 9, 1897, amid the green rushes where Long- and Short-billed Marsh Wrens were breeding, I ran across a pair of Yellow-throats * * * in some high rushes in about four feet of water, and upon investigating I found the nest placed almost level with the water in a thick clump of cat-tails, over fifty feet from shore, and right in the midst of a colony of Marsh Wrens."

Often individuals take up their residence in dry upland situations remote from water. They may be found along old fence rows grown up with weeds and tangles of briers and shrubbery, in huckleberry or raspberry or blackberry patches, and along the margins of woodlands and neglected country roadsides. Maurice Brooks (1940) reports that in the central Allegheny Mountain region where the spruces have been cut, the northern yellowthroats have invaded the highest mountains and are now abundant at all altitudes.

I have found it a very common nesting bird on many of the small outer islands off the coast of Maine. Some of these islands are without any source of fresh water and the only apparent attraction is a growth of rank grass and weeds and briers, and the extreme isolation from enemies, that such sites provide. For example, on Outer Green, a tiny islet of a few acres, there is a bit of tall grass and weeds only a few square yards in area, but it is sufficient to serve each year as the home of a pair of northern yellowthroats. On some of the larger islands where there is no fresh water other than rain I have seen as many as four pairs, all of which apparently were nesting.

The nest of the yellowthroat is frequently placed on or a few inches above the ground and is securely lodged in tussocks of grass, reeds, cattails, briers, and sometimes in herbaceous plants such as skunk-cabbage and similar vegetation. Quite often the grass in which the nest is built is backed by a shrub or small tree. The nest is always well concealed from view until the grass or shrubs are parted. This in addition to the secretive habits of the birds makes the task of locating the nest most difficult. All I have seen were accidently found by flushing the bird from the nest when scouting through masses of vegetation in search of other birds.

Although the yellowthroat's nest is commonly located on or within a few inches of the ground there are numerous instances in which the nest is secured to tall weed stalks or shrubs well above the ground. I. D. Campbell (1917) describes a nest of the Maryland yellowthroat that he found at Bernardsville, N. J., which was located in an alder, 3 feet above the ground. R. B. Simpson (1920) found a nest in the top of a cluster of laurels that was growing among a growth of hemlock trees. Mr. Simpson states that this nest was more like that of a mourning warbler than of a Maryland yellowthroat. William Brewster (1906) writes: "I have twice found it nesting in ground junipers in perfectly dry upland pastures near Arlington Heights" [Massachusetts]. Others have found nests in a diversity of situations indicating a great deal of individual variation as far as the selection of the nesting site is concerned.

One most unusual situation for a nest is described by A. W. Brockway (1899) of Old Lyme, Conn., as follows:

> The locality chosen was near a back entrance to a house situated on the main street of town. A pair of shoes, which were the property of my friend, were placed outside of the door on the under pinning which projected out from the side of the house about two feet. One day he had occasion to wear them and went out and brought them into the house; * * * he discovered something in one of them, and upon examination found it to be a nest. The other shoe contained a few dry grasses and other fine material but for some reason the bird gave up the idea of building in that, and took up housekeeping in shoe No. 2. My friend immediately put the shoes back, thinking that she would return, and upon glancing into the shoe the next day was surprised to see that it contained an egg.

The yellowthroat continued laying until she had deposited five eggs.

P. G. Howes (1919) found a nest of the Maryland yellowthroat near his house in Stamford, Conn., which was effectively guarded by a nest of large hornets. According to Mr. Howes, the birds did not bother the wasps and the wasps respected the birds; a case of symbiosis.

The nests of the yellowthroat are not always isolated from others of their kind. For example Isaac E. Hess (1910) found 17 nests in a half-acre swamp in central Illinois. This small swamp was in an extensively cultivated agricultural area, a region where suitable nesting sites are few in number. This unusual concentration of nesting birds was probably due to necessity rather than to choice.

The nest is a rather large, bulky structure composed of dead grass, weed stems, dead leaves, grape vine bark, dead ferns, etc. all loosely put together. The lining consists of fine grasses, tendrils, delicate fibers of bark, and often a quantity of hair.

The external parts of a nest, located in a meadow, was made up of wide blades of fresh grass lined with moss. Nests in cattail marshes had a foundation of cattail shreds, dried leaves, and grass stems and were lined with fine grasses only.

The nest is cup-shaped but in some instances loosely attached material extends above the main rim and may partially roof over the top of the structure. The average measurements of several typical nests, not including protruding materials, are outside diameter 3¼ inches, outside depth 3½ inches, inside diameter of the cup 1¾ inches, and its depth 1½ inches.

All nests that I have seen were completed when found, and I have no information as to the time required or the manner in which the nest is built. The female apparently builds the nest, but on one occasion I saw a male bird carrying nesting material and it is probable that he sometimes assists his mate in its construction.

Eggs.—The usual set of the northern yellowthroat is four eggs but complete sets vary from three to five, and as many as six eggs have been reported. The eggs have a ground color of white or creamy white specked chiefly at the larger end with reddish brown, umber and black and with shell markings of stone gray. As in any large series of eggs of a species there is more or less variation from the typical. In some eggs the markings are in a distinct wreath near the larger end, in a few, some of the marks are in the form of small streaks and in still others the marks are faint and much reduced. The average size of two sets of four eggs each is .69 by .52 inch.

[Author's Note: The measurements of 50 eggs of the northern yellowthroat average 17.5 by 13.3 millimeters; the eggs showing the four extremes measure **19.4** by **14.5,** and **14.2** by **11.7** millimeters. The measurements of 26 eggs of the Maryland yellowthroat average 16.7 by 13.2 millimeters; the eggs showing the four extremes measure **18.3** by 13.8, 17.5 by **14.0,** and **15.4** by **12.1** millimeters.]

Incubation.—The incubation of the eggs requires 12 days and is performed entirely by the female. The male sings throughout the incubation period and is ever alert in defending his territory. He sometimes delivers foods to the female while she is incubating the eggs.

H. Mousley (1917) has found that although the eggs of different individual northern yellowthroats are subject to great variation, the successive sets of any one bird are strikingly alike in shape, size, and markings. Mr. Mousley did not succeed in getting the yellowthroat to lay a third set of eggs after the first two sets had been taken. It is doubtful if the yellowthroat rears more than two broods a year, although Aretas A. Saunders (1938) believes that some of them do, since he has found the last birds leaving the nest in August. Usually an egg is laid each day until the set is completed but L. H. Porter (1908) reports finding a nest on June 4 in which the set of four eggs was not completed until June 12, a case, according to Porter, in which the deposit of the eggs was greatly prolonged by cold weather.

Unlike many birds, the northern yellowthroat usually leaves the nest unobtrusively when a human intruder comes near and does not betray its location by scolding. In the case of one nest the female sat very closely, and by exercising care I was able to almost touch her before she slipped off, mouse-fashion. She crept silently through the grass to the shelter of the neighboring vegetation and from there watched me intently. On another occasion the reaction of a yellowthroat was very different in respect to a small dog. Both birds made a wild demonstration, calling and scolding loudly and even making passes at the intruder in their efforts to drive him away from the vicinity of the nest.

The birds readily adapt themselves to a blind placed close to the nest, although their suspicions may be aroused at first. A day after the blind is in place they pay little attention to it, and I have had the bird return within 20 minutes after I had entered the structure.

Young.—The young at the time of hatching are nearly naked, having only scant tufts of grayish or mouse-colored down on the crown and dorsal tracts of the body and wings. The eyes are sealed shut. Soon after emerging from the eggs the young are active and open wide their mouths in anticipation of food, which arrives before many minutes have elapsed. In one nest under observation the male delivered the first food in the form of a small, green insect larva. During the first day the male did the major part of the feeding, since the female remained at the nest much of the time to brood the delicate young. She was seen to leave the nest but twice during the first day, probably in search of food· During the first few days the male frequently delivered food to the female at the nest, and she in turn fed it to the young.

By the third day the papillae of the developing feathers of the primaries, secondaries, and tertials, and to a minor degree those of the dorsal tract, have pierced the integument. The remainder of the body remains naked except for the persisting tufts of down.

On the fourth day the eyes are open for the first time. The response of the young to the presence of the adults is much more marked than during the first days. Both male and female now share about equally in the arduous task of feeding the young, the food still consisting chiefly of insect larvae or soft-bodied adult insects. In feeding, at one nest I had under observation, the adult birds approached the nest silently, except for low twitters. They sneaked through the grass, selecting definite pathways more or less hidden by the vegetation, thus giving an observer little warning of their approach. The female did all of the brooding, but by the fourth day she spent less time at the nest and took more excursions in search of food.

The young usually emit a fecal sac after they are fed, and this is immediately seized by the parent that chances to be present. During the first few days the fecal sacs are usually eaten, but in later nest life they are more often carried away some distance from the nest and dropped. I have seen the female eagerly keep watch for fully 5 minutes in anticipation of the fecal sac, even stimulating the youngsters with the tip of her bill to make them respond. The birds also removed all other foreign material such as a pellet of gum, small wads of paper, or rolled-up leaves purposely dropped into the nest as an experiment. The eggshells were removed at the time of hatching by the female. Nelle E. Shaver (1918) gives an interesting account of the removal of an addled egg as follows:

> The nestlings had crept to one side of the nest to escape the rays of the sun, so that the addled egg remained alone and in plain view. The male Yellow-throat came first to the nest with food. Seeing the addled egg he picked it up between the mandibles and carried it away, without breaking it and with no slips or unsuccessful trials. The bird, carrying the egg, disappeared in the foliage of the trees at a distance of about twenty-five feet from the nest. It is possible that the ridge formed by the shell fragment may have furnished a "grip" by which the egg was firmly held in the mandibles. On the other hand, the mandibles are capable of opening to a surprising degree, and the whole behavior of the bird in this act seemed to proceed without uncertainty or experimentation.

This behavior is probably unusual, as in nests that I have had under observation the infertile egg remained until after the young normally left the nest.

By the fifth day the papillae of the larger feathers are bursting from their tips and this process is considerably advanced by the following day. At times the adult birds peck at the feathers apparently to facilitate the process of unsheathing. On the sixth day the young exhibit evidence of fear when a human observer examines the nest. The food delivered at this time consists of many adult insects such as small moths, spiders, beetles, and grasshoppers. A. C. Redfield (1911) made a unique observation concerning the order in which the young are fed, as follows: "On one occasion the male fed two of the young. Before he had left, the female arrived with an insect. He held his bill toward her as though wishing to take the food from her. Not heeding him she proceeded to feed the young one last favored by the male. Quickly her mate removed the food from the young one's mouth and thrust it into the bill of the third young one, which had received nothing. This would make it appear that the parent birds do actually keep account of which young they have last fed." Mr. Redfield's interpretation may be correct, but it is rare for birds to exhibit such intelligence or to detect the sequence in which the young are fed.

By the eighth day the feathers have proceeded in the unsheathing process to such an extent that the young present a smooth and pleasing contour. A few tufts of down, however, still cling to the ends of some of the contour feathers. Now that the young have a substantial protective covering and have acquired a temperature control, continuous brooding is not essential, but during extreme weather conditions, such as a cold rain or when the nest is exposed to the direct rays of the sun, the female protects the young by shielding them with her half-spread wings.

On the ninth day the young are ready to leave the nest and the least disturbance at the nest is a signal for them to leave. Under normal conditions they remain at the nest until the tenth day.

On June 10, 1945, I flushed a juvenal northern yellowthroat from the tall grass on Cone Island, off the coast of Maine. It flew but a few yards and alighted on a limb of a small dead shrub. The bird then allowed me to approach very near and exhibited not the least fear of my presence or that of the three other observers who stood nearby staring at the little creature. When we continued on our way the bird persisted in following us alighting again and again within a few feet of us. The youngster followed us in this manner for nearly a mile, until finally it joined company with an adult male, possibly its parent, and together they disappeared in the dense vegetation.

A. D. DuBois sends notes of his observations of a northern yellowthroat caring for a young cowbird and of its own young at Lincoln, Illinois, on June 21, 1913: "Found a female yellowthroat caring for a young cowbird which could fly very well and was about twice her own size. The cowbird flew to a bush near me. Its foster mother was nearby with food in her bill but she became agitated at my presence and flitted about, chirping. I suddenly clapped my hand over the young cowbird and thus caught it. The cowbird cried out with its squeaky voice and both male and female yellowthroats were immediately on the scene of the disturbance, fully as much concerned as though this young rascal were their own flesh and blood. The male, particularly, spread and fluttered his wings in a little bush 10 or 15 feet away, exhibiting great excitement, while the female chirped nervously from beneath a bush on the other side. They did not flutter along the ground as many birds do but remained in the weeds and bushes while doing all in their power to attract my attention. Sometimes the male held up his wings in a very pretty fashion. When I released the young cowbird it flew probably 100 feet, the foster mother following after it.

"Later, in the same bushy, weedy pasture, I caught a young yellowthroat, with much difficulty—a pretty little fellow much like the adult female, but with its tail just sprouting. I think this belonged to other parents. They made much less fuss about their own offspring than did the other pair about the young cowbird."

The young are cared for by the adults for an unusually long period after they leave the nest, this being especially true of the second brood of the season, when parent birds may be seen feeding young that are able to fly as well as the adults, and apparently long after the young are capable of caring for themselves; in fact, they have been seen feeding their young up to the time of the fall migration. It is possible that the fall migration starts as a family group.

Plumages.—The juvenal plumage which is acquired by a complete molt of the natal down is described by Dr. Dwight (1900) as follows: "Above, pale olive-brown of variable depth, greenish on the upper tail coverts. Wings olive-brown edged with olive-green, the median and greater coverts faintly tipped with cinnamon. Tail bright olive-green. Below, tawny wood-brown, Naples-yellow on the abdomen and olive-yellow on the crissum. Inconspicuous orbital ring pale buff. Bill and feet pinkish buff becoming deep sepia with age."

The following plumages of the Maryland yellowthroat are also described by Dr. Dwight: The first winter plumage is acquired "by a partial postjuvenal molt, beginning about the middle of July, which involves the body plumage and the wing coverts, but not the rest of the wings nor the tail." It is unlike the previous plumage in being "above, deep olive-brown, greener on the upper tail coverts, the crown and forehead tinged with Mars-brown, the forehead frequently with a very few feathers black basally. The wing coverts chiefly olive-green. Below, bright lemon on the chin, throat and crissum, pale straw-yellow on the abdomen, the flanks washed with olive-brown, and a very faint buffy pectoral band." Dr. Dwight notes that "the malar and auricular regions show traces of the black mask varying from a few black feathers to a considerable area always veiled by ashy edgings. The black seldom invades the lores and forehead and never the orbital ring as in the adult. The orbital ring is buffy white."

The first nuptial plumage, he says, is acquired "by a partial prenuptial moult which involves chiefly the forehead, crown, sides of head and chin and not the rest of the plumage. These areas are somewhat worn, as a rule, when the birds reach New York in May, but specimens from Jamaica, West Indies, taken December 2nd, January 9th, 22d and 24th and February 4th show actual moult in progress. It is not surprising that the feathers assumed should show considerable wear before May. The black feathers of the 'mask' are acquired."

He says that those of the upper margin of this area are broadly tipped with pearl-gray, which becomes ashy with wear. "This gray band, posteriorly on the crown, has its feathers tipped with Mars-brown and the basal black gradually diminishes more posteriorly as the extent of brown on each feather increases. There is a yellow tinge in some of the feathers. The width of the band varies greatly. The bright yellow chin is also acquired and young birds and old become indistinguishable."

The adult winter plumage is acquired "by a complete post-nuptial moult in July and August. It differs from the first winter dress in possessing a complete black 'mask', which includes the forehead, lores, orbital ring and auriculars, only the forehead and the auriculars being slightly veiled. The 'mask' has a distinct cinereous posterior border veiled on the crown with Vandyke-brown. The yellow below is deeper and the brown wash on the flanks darker in most cases." He reports that 6 specimens out of 22 in this plumage show a few white feathers in the orbital ring, usually confined to the lower eyelid, and 3 out of 23 spring males show the same peculiarity, which seems to be purely individual and possibly peculiar to the younger birds.

The adult nuptial plumage is "acquired by wear," although he thinks there must be only a limited prenuptial molt, for he examined specimens of this species taken every month in the year, but found "only a few young birds showing actual moult in February, March and April." He adds that "the adult nuptial and winter plumages are so extremely similar that wear alone might convert the latter into the former," although even with the large series he examined positive conclusions were not possible.

In the female "the plumages and moults correspond to those of the male. In juvenal plumage the sexes are alike. In first winter plumage the female is much browner, the yellow of the lower surface is wholly replaced by buff, and there is no black about the head. The first nuptial dress is assumed by a limited prenuptial moult (sometimes suppressed) illustrated by a specimen of February 4th. Later plumages differ little, except in yellowness, from the first winter dress and no black is ever assumed about the head."

Albinistic plumages of the yellowthroat have been reported.

Food.—In the case of the yellowthroat, as of other birds which usually inhabit places remote from agricultural areas, no studies based on the stomach contents of a large and representative number of individuals has been made. However, from various field observations and the few stomachs that have been examined we know the yellowthroat is insectivorous in its food-eating habits. In its nesting haunts it has been observed feeding on beetles, grubs, larvae and adults of moths and butterflies, flies, ants, spiders, plant lice, and such insects as leafhoppers and leaf rollers which are abundant among the grass and low-growing herbage that it frequents.

E. H. Forbush (1907) writes: "I watched a Maryland yellowthroat on the low willow sprouts, and saw him pick off fifty-two gipsy moth larvae before flying away." Mr. Forbush concluded in his study of the gipsy moth infestation in Massachusetts that the yellowthroat ranked among the efficient enemies of this pest. At another time Mr. Forbush saw one eat 89 aphids during the course of one minute.

S. A. Forbes (1883), in the examination of three stomachs of the yellowthroat, found four-fifths of the food consisted of canker worms and other undetermined caterpillars, 8 percent consisted of Coleoptera (beetles), gnats amounted to 4 percent, and a small hemipteran (*Piesma cinerea*) was found. Others have reported yellowthroats in orchards where their chief food seemed to be cankerworms. A. W. Butler (1898) gives the summary of food eaten by 11 specimens of the yellowthroat examined by Prof. F. H. King as follows: 22 case-bearing caterpillars, 5 other larvae, 6 small dragonflies, 3 moths, 3 dipterous insects, 3 small hymenopterous insects, 3 beetles, 3 spiders, 2 small grasshoppers, 1 leafhopper, 2 hemipterous insects, and 2 insect eggs. J. Henderson (1934) quotes Aughey as having reported 8 locusts in the stomach of a single Maryland yellowthroat. C. W. Townsend (1905) found beetles, flies, and small seeds in the stomach of a Maryland yellowthroat he collected at Ipswich, Mass., on December 6, 1903.

Under ordinary conditions the yellowthroat secures its food in an environment remote from agricultural areas, orchards, and gardens; thus it may be thought to be of little economic importance. However, since many destructive insects breed in areas inhabited by these birds, and from there spread to cultivated areas, the yellowthroat can be considered a useful insectivorous bird in its food-eating habits.

Nelle E. Shaver (1918) who made a nest study of the Maryland yellowthroat at the Iowa Lakeside Laboratory on Lake Okoboji has presented detailed and painstaking observations on the food delivered to the young by the adult birds. Miss Shaver summarized the results of 1,694 observations made over the entire nesting period from the time the young hatched until they left the nest. The food delivered was as follows: Unidentified insects 376, moths 347, various larvae 290, spiders 280, mayflies 116, flies 61, unrecognized material 92, caterpillars 20, damselflies 54, beetles 13, chrysalids 13, butterflies 11, seeds 10, caddisflies 3, grasshoppers 6. Miss Shaver states further:

> The birds gleaned their food from the ground and the shrubbery close to the ground. The greater amount of the food for the young was such as must have been picked from low bushes around the nest. The small moths which were so numerous in the grass, seemed to afford an unfailing source of supply. * * *

The "worms" were the usual miscellaneous assortment, mostly with a greenish color. These were, of course, gleaned from the foliage. The number of spiders taken by these birds was an interesting fact. * * * Sometimes the food morsel was large, and the time required by the young in swallowing made identification possible. At other times the food was small and the feeding process was so rapid that identification was impossible. Much of the small stuff may have consisted of plant lice, etc.

Voice.—The northern yellowthroat may be heard in full song soon after the arrival of the males in spring. Although the song is subject to great individualistic and local variations its characteristic rhythm and the loud, clear, and strongly accented syllables make it distinctive and easily identifiable. But while the song of the yellowthroat lends itself readily to syllabification, few interpreters agree as to what the bird seems to say. It utterances have been rendered as: *I beseech you*, *I beseech you*, *I beseech you; witchity*, *wichity*, *wichity; witch-a-wee-o*, *witch-a-wee-o*, *witch-a-wee-o; peachity*, *peachity*, *peachity*, etc. Witmer Stone (1937) in his study of the Maryland yellowthroat at Cape May, N. J., emphasizes the idividual variation of the song. He states that no two appeared alike, although each carries a similar phrase that is characteristic and gives to all songs an impression of identity. He offers 13 interpretations of songs he recorded and claims that it was very easy to identify individual birds after their songs were memorized.

Aretas A. Saunders has given us his interpretation of the song as follows: "The song of the yellowthroat consists of 3 or 4 repetitions of a phrase of 2 to 6 notes, with 1 note of the phrase strongly accented. The phrases vary greatly in different songs and individual birds. Some phrases are very common, while others are comparatively rare. 3- or 4-note phrases are much commoner than others. In 106 records of the song of this species, only 1 is of 2-note phrases; 7 are of 5 notes and 3 of 6. The remainder are almost equally divided between 3 and 4. In 5 of these records the phrase is sung only twice; in 67 records three times, in 32 four times, and in 2 five times.

"Probably the commonest phrase is one of three notes, the first highest in pitch, and the last lowest; the first note the one usually accented. This is commonly sung with three full phrases and the first note of a fourth, *wit'ato-wit'ato-wit'ato-wit*. This is sometimes varied by making it a phrase of four notes, each lower in pitch than the preceding one, making the phrase *wee'titato*. In the Allegany State Park this is the commonest yellowthroat song. Another common song has the second note highest, and accented, *witee'to*, and this is varied by two notes on the same pitch before the accented note *titiway'to*. There are many other variations, but they seem to be less common than these. In all these, however, the song is readily recognized, for it is much more definite and distinctive than most warbler songs.

"The pitch of songs varies from D''' to D'''', or one octave. Single songs commonly have a range of one and one half to two and one half tones, a very few only one tone, and a few others up to three and one half tones. Songs vary in the rapidity of the phrases and range from 1⅖ to 2⅖ seconds in length. Usually about two phrases occuy 1 second of time."

The song of the northern yellowthroat may be heard throughout the nesting season but in the last weeks of July and the first week of August singing is less general and less spirited. I have never heard the song in Maine after the last week of July, but observers in other sections of its range have heard it throughout the month of August and as late as the second week of September, although this late singing is unusual. M. B. Trautman (1940) in his intensive study of the birds of Buckeye Lake, Ohio, writes: "The song period began with the first male arrivals in the spring, reached its height in mid-May, and continued undiminished until late June. There was less singing in early July, and by August it had ceased almost entirely. A few birds continued to sing throughout summer and fall, especially in the early morning. An individual on Lieb's Island sang during late October and until November 2, 1929, the last day on which it was observed." Others have reported individual birds remaining throughout the winter, as far north as Toronto, Canada, that were heard singing their characteristic song in spite of snow and severe weather conditions.

Aretas A. Saunders writes that the northern yellowthroat sings until August 1, an average based on 14 seasons in Allegany State Park. The latest date on which the song was heard was August 8, 1929. Frank L. Burns (1937) states that the approximate duration of the yellowthroat's song is 87 days, extending from May 5 to July 31. Of this time the two nesting cycles were in progress for a period of 77 days. In Arkansas W. J. Baerg (1930) writes that in a 5-year period of study the average singing period extended from April 15 to August 10, or 117 days, about a month longer than the determinations made by Burns in Pennsylvania.

The northern yellowthroat seems to exhibit some ability in imitating the song of other birds. E. M. S. Dale, of London, Ontario, writes to us: "For several days in early May 1933, we heard a chipping-sparrow-like song coming from the edge of Spettique's Pond (a mile or two south of London). We were unable to catch a glimpse of the singer until the fifteenth, when we got a good look at it in the very act, and were much surprised to find that it was a northern yellowthroat. We were wondering if it had been listening to swamp sparrows and had copied them. In 1936 a similar case occurred, when we heard what we took to be a short-billed marsh wren singing, only to find that it was the yellowthroat again. I guess we would have all put it down for a wren without thinking a second time, but one of the party took the trouble to look it up. On May 14, 1937 we heard what was without doubt the same bird singing the same wren song from the same location. Here are two instances of a marsh bird whose song imitated very closely the songs of two other marsh birds, the normal songs of the three species being about as unlike as it is possible to get them."

H. Mousley (1919) has determined that the "singing tree," or the place selected by the male for singing, was near the nest; in five nests the distance varied from only 7 to 11 yards. He found this information useful in locating the nests.

H. W. Wright (1912) found that the awakening song of the Maryland yellowthroat at Jefferson Highland, in the White Mountains of New Hampshire, begins on an average at 3:51 a.m. but varied from 3:41 to 3:55 a.m.

The yellowthroat in its haunts is generally well concealed from view, and since it is readily excited and disturbed by our approach, the first indication to us of his presence is a sharp *tchch*, *schick*, or *chit* note which is excitedly uttered as he hops nervously about in the thicket closely scrutinizing our movements to determine whether we are friend or foe. At other times he may be heard to utter a slight *chip* or *tip* note.

In addition to the ordinary, or territory, song the yellowthroat has a so-called flight song which is more generally heard late in the season after the birds have begun nesting. The flight song is not so highly developed in the yellowthroat as it is in the true flight singers of the open grass areas, nor is it as spectacular as the performance of two other warblers, the ovenbird and the yellow-breasted chat. The flight song of the yellowthroat is merely an outburst of ecstasy consisting of short, confused, and sputtering notes, but generally including phrases of the common song. It is uttered as it gracefully flies up from the ground to a height of 15 to 20 feet. The song ends while the bird is at its highest point of the flight. He then silently drops to the place from which it started. The flight song is more often heard in the late afternoon or toward evening than it is during the early part of the day.

E. H. Forbush (1929) presents an account of a flight song of the yellowthroat, which was most unusual for the height at which the bird flew during the performance, as follows:

> There is an occasional song-flight that goes far beyond the ordinary. I recall but one high-flyer, and probably a high flight is very unusual. One such is de-

scribed by Miss Florence M. Pease as follows: "On May 14, 1914, I saw a Maryland yellow-throat fly very high, then spiral down and then fly off toward the church, where it was still a good distance from the ground. I was not able to estimate accurately how many feet the bird flew up, but I noted that when it began to spiral down it was far, far above the church steeple. I had always supposed that the flight-song of the Maryland yellow-throat was given from a height of a few feet."

Enemies.—The yellowthroat is subject to the usual enemies of birds that nest near or on the ground. I remember finding a nest of the yellowthroat in a grassy area near a meandering meadow brook in central Illinois where snakes were common. During a second visit to the nest, when the young were 3 days old, I saw a large water moccasin disappearing into the vegetation as I approached. Two of the young were missing and I presume, judging from the behavior of the adults, they were victims of the unwelcome visitor.

A. L. Rand (1943) cites a report from Lake Okeechobee, Fla., in October 1942, where a 3-pound large-mouthed bass was found to have a yellowthroat in its stomach. These fish often feed in shallow water among the water-hyacinth where they could easily capture a bird as they do various insects on or near the surface. Mr. Rand mentions reports of other birds captured by black bass and since yellowthroats are frequent visitors to such situations in quest of insects, it may not be a rare incident. Turtles have been known to capture small birds and may also prove to be an enemy of the yellowthroat.

However, the number of yellowthroats that fall victims to natural enemies are insignificant when compared with the appalling losses suffered by this species during the migration, especially when the great migration waves meet with severe storms and foggy weather. D. E. Culver (1916) gives an account of a large number of birds that were killed on May 21 and 22, 1915, by flying into public buildings and the City Hall in Philadelphia. On May 21 there was a heavy mist or fog prior to the storm, but this was later cleared away by falling rain. Many of the birds became exhausted from continuous fluttering about the lights and later succumbed to exposure, but the death of the majority was caused by dashing into the structures. The Maryland yellowthroat suffered the greatest mortality, Mr. Culver recovering 130 of this species of which three-fourths were females. This sex ratio was due to the lateness of the season, as the males are the first to migrate. Culver also reports that during a migratory wave, October 17 and 18, 1915, the yellowthroat was again killed in large numbers, the total being exceeded only by that of the myrtle warbler.

Robert Overing (1938) on September 12, 1937, between 10:30 p. m. and midnight identified 576 individuals of 24 species which struck the Washington Monument. There was a slight mist enveloping the top of the shaft and the wind velocity was 8 to 10 miles an hour. Mr. Overing identified 189 Maryland yellowthroats and other subspecies of *Geothlypis trichas.*

W. E. Saunders (1930) writes of the great loss of bird life at Long Point lighthouse, Ontario, during certain nights of September 1929. Out of 2,060 birds killed on September 7, 9, and 24–29, 254 of them were Maryland yellowthroats, this being the most frequent victim of the 55 species reported.

A. M. Frazar (1881) reports a great destruction of birds on April 2, 1881, during a sea trip from Texas to Mobile, Ala. Land birds including a great number of Maryland yellowthroats were seen to perish. Even those that came aboard the boat were washed into the sea again.

The yellowthroat is a frequent victim of parasitism by the cowbird. L. E. Hicks (1934) reports that out of 41 nests of the northern yellowthroat he has found 19, or 41 percent, that were parasitized by the cowbird. Dr. Friedmann (1929) states that at Ithaca, N. Y., the yellowthroat stands seventh in order of the birds most frequently imposed upon by the cowbird. There are many instances on record where the cowbird has been successful in having the yellowthroat accept its eggs and of rearing the young to maturity. However, some circumvent the intrusion by building a second nest over the first containing the egg of the cowbird, a method frequently employed by the yellow warbler. A. W. Butler (1898) writes of a 3-story nest of the yellowthroat as follows: "Mr. E. R. Quick has in his collection a three-story nest of this bird, taken near Brookville, Ind. Two additional nests were built upon the original structure, burying beneath each the egg of the cowbird (*Molothrus ater*). Thus it outwitted the detestable parasite, and in the third nest deposited her complement of eggs. Similar nests have been found elsewhere, showing that this is not an individual peculiarity, but others of its kind had experimented along the same line."

The northern yellowthroat is host to a number of external parasites of which Harold S. Peters (1936) has identified the louse *Ricinus pallens* (Kellogg) and the two flies *Ornynoica confluenta* Say and *Ornithomyia anchineuria* Speiser.

Fall.—There are so many breeding birds on the migration range of the yellowthroat that it is not easy to mark the beginning of the southward migration in the autumn. The bulk of the birds leave their northern breeding grounds in September, but even in these northern sections many birds linger well into October, a few as late as November. Indeed there are a number of records of birds seen throughout the winter months.

M. B. Trautman (1940) writes of the fall migration at Buckeye Lake, Ohio, as follows: "Upon a few occasions the *chip* note of night migrating birds was recognized as early as late July, and a few apparent transients were seen dropping earthward in the early mornings. Evidence of migration was always apparent by August 10. The peak of migration took place between late August and late September, and then the species was as abundant as in spring. It disappeared between October 5 and November 2." At Oneida Lake, N. Y., according to D. Stoner (1932) fall migration begins in September and by mid-October practically all of the birds have left the territory.

At the Florida lighthouses, where specimens have been recovered, thus making it certain that individuals of the northern yellowthroat are migrating, the first birds appear about the middle of September. They are reported to reach Cuba during the last two weeks of the month. The earliest arrivals reach Jamaica the first week of October and have been reported in Nicaragua during the last week of October.

Winter.—The winter ranges of the northern and Maryland yellowthroats overlap to a great extent. The records are confusing in certain cases, and we cannot be sure that the races are properly designated. The northern yellowthroat winters from southern United States to the Bahamas and the West Indies and through eastern Mexico to Costa Rica. The Maryland winters from North Carolina and Louisiana to Florida, the Bahamas and Haiti. An adult male was taken by Todd (1922) as far south as the Santa Marta region, Colombia.

Dickey and Van Rossem (1938) have found the northern yellowthroat a common midwinter visitant in El Salvador. They write as follows:

> The northern yellowthroat was not detected in the fall, even in localities where later in the year it was present in numbers. It is safe to say that few, if any, reach El Salvador before about January 1, after which date the species is common and generally distributed in marshland, shrubbery along streams, and even in fern bracken up to 8,000 feet in the Arid Upper Tropical Zone.
>
> The northward migration is chiefly during early April. At Lake Olomega from April 1 to 8, 1926, and at San Salvador until April 17, 1912, yellowthroats were very common, much more so than during the winter. However, some individuals remain very late in spring; indeed, locally, they are sometimes actually common in the middle of May. An instance of this is the fact that at Lake Chanmico from May 13 to 17, 1912, *brachidactyla* was frequently noted in the grass and mimosa scrub about the edge of the lake. A peculiarity of this occurrence was that the birds were usually in pairs. The two males taken were in breeding condition, and the single female had rapidly developing ova.

Dr. Alexander F. Skutch has sent us the following notes concerning the yellowthroat (races not designated) in Central America: "Like so many of the warblers that winter in Central America, the yellowthroats are abundant in the north but rare in the south. In Panamá and Costa Rica it has been very rarely recorded; I have seen it only once during eight years in these countries. In Guatemala, it winters in fair numbers at lower elevations, on both sides of the Republic, upward to at least 3,000 feet above sea level. I saw two at Panajachel, 5,000 feet above sea level, in late October; but it is possible that at this date they had not yet settled down for the winter. This single bird I met on the Sierra de Tecpán, at 8,500 feet, on March 7, 1933, was obviously only a transient—I saw no other of the kind during the course of the year. In the lower Motagua Valley, I found the yellowthroat an abundant winter resident; and it was not rare on the great coffee plantations of the Pacific slope. It frequents low-lying pastures where the grass is tall, moist thickets, and the brakes of giant cane along the rivers. Always solitary, it shows no tendency to flock.

"The yellowthroat arrives late and apparently has not been recorded before October. In April, when the migratory movements begin, these birds become exceedingly abundant in the Motagua Valley of Guatemala. They linger into May, rarely past the middle of the month; and I have recorded males as late as females. On May 7, 1932, I heard a male, the last of his kind I saw that year, sing repeatedly but rather weakly, among tall, lush grass in the Motagua Valley."

Dr. Barbour (1923) states the northern yellowthroat is a common winter visitant in Cuba, where it is found about marshes, in cane brakes and reed beds, and in lowland thickets of vines and lianas.

In the Isle of Pines, W. E. C. Todd (1916) states that the Maryland yellowthroat is a common winter resident throughout the northern part of the island where it inhabits the low, wet thickets.

In Haiti and the Dominican Republic, Wetmore and Swales (1931) state: "The yellow-throat is found in numbers at the proper season in weed-grown fields, and the borders of marshes in the lowlands, and also ranges widely into the higher altitudes where there is suitable cover for it. It lives near the ground concealed in the dense growths that it affects, coming out on open perches for a few seconds and then dodging quickly out of sight, or flushing with tilting flight to fly for a few yards before disappearing again into its coverts. Attention often is directed to it by its harsh call note, a low *chimp*, as it scolds whenever disturbed."

So many individuals of yellowthroats have been found wintering well north of the usual winter range of these birds that it has become something more than an accidental occurrence. A few representative records in this connection are of interest. Baillie and Thompson (1928) report that a Maryland yellowthroat was seen December 25, 1927, in a sheltered ravine of Hyde Park, Toronto, Canada. It was a male in good plumage; it was active and uttered its characteristic song. M. B. Trautman (1933) saw a male northern yellowthroat during a severe cold snap during mid-March at Buckeye Lake, Ohio. It was wintering in the cattails which stood beside a 2-foot snow drift at the time it was seen. The bird was collected and upon examination was found to be fat and in apparently good condition.

C. W. Townsend (1905) writes: "I found a Maryland yellow-throat on December 6th, 1903, in the sand dunes just back of Ipswich Beach, among some bayberry bushes and goldenrod stalks. There was about an inch of snow on the ground and the thermometer early in the morning was only 15° F. The bird proved to be a young male, quite fat, with its stomach filled with insects, mostly beetles and flies, and a few small seeds. Its plumage was interesting, as it had partially assumed the first nuptial plumage." Since Dr. Townsend's winter record there have been numerous winter records of the northern yellowthroat in Massachusetts as well as in other sections of New England. The yellowthroat is a regular winter resident from North Carolina southward.

DISTRIBUTION

Range.—North America, Central America, and the West Indies.

Breeding range.—The yellowthroat breeds **north** to southeastern Alaska (Chickamin River); southern Yukon (Jarvis River at Alaska Highway, Champagne, and Pelly River); northern Alberta (Peace River area, and the Athabaska Delta); south-central Saskatchewan (Manito Lake, Emma Lake, and Yorkton); southern Manitoba (Brandon, Aweme, Pembina, Lake St. Martin, Shoal Lake, and Carman); central and northern Ontario (Kenora, Lac Seul, Roseport, Amyot, and Moose Factory); central and southeastern Quebec (Mistassini Post, Lake Albanel, Godbout, Mingan, Natashquan, and Anticosti Island); and southern Newfoundland (Lewis Hills, Grand Lake, Pushthrough, possibly Gooseberry Island, and Exploits River). **East** to Newfoundland (Exploits River); Connecticut; New York; eastern Pennsylvania; western Maryland (Cranesville); Virginia (Emporia, Pungo, and Dismal Swamp); North Carolina (Wadesboro and Raleigh); South Carolina (Greenwood, Lancaster); Georgia (Atlanta, Athens, Newton, and Saint Marys); and eastern Florida (Gainesville, Micanopy, Deep Lake, Royal Palm Hammock, and Miami). **South** to Florida (Miami, Tallahassee, and Pensacola); southeastern Alabama (Abbeville and Dothan); southern Mississippi (Gulfport and Biloxi); southern Louisiana (Pilot Town, Houma. Vermillion Bay, and Sunset); southern Texas (Brownsville); northwestern Chihuahua (probably San Diego); and Colima (Colima and Manzanillo). **West** to Colima (Manzanillo); Nayarit; Sinaloa; Sonora (Tepopa Bay and Kino Bay); Baja California (San Ramón, Rosario, San Felipe); coastal California (Santa Barbara, San Rafael, San Francisco Bay); western Oregon (Portland, Salem, and Corvallis); western Washington (Sumas, Seattle, Grays Harbor, Tacoma); western British Columbia (Kispiox Valley, Hazelton, Comax, and Chilliwack); to southeastern Alaska (Chickamin River).

Winter range.—The yellowthroat winters **north** to northern California (Eureka); southern Arizona (Yuma and Tucson); southern Texas (Brownsville and Beaumont); southern Louisiana (Chenier au Tigre, Grand Isle, and New Orleans); southern Mississippi (Biloxi); and North Carolina (Raleigh and Lake Mattamuskeet). **East** to North Carolina (Lake Mattamuskeet); Georgia (Atlanta and Savannah); throughout Florida; Cuba (Isle of Pines); Jamaica; the Bahamas (Bimini, Andros, Nassau, and Hog Island); Haiti (Gonâve); Dominican Republic (Fort Liberté); and Puerto Rico (Guajatico Reservoir). **South** to Puerto Rico (Guajatico Reservoir); and Panamá (Volcán de Chiriquí). **West** to Panamá (Volcán de Chiriquí); Costa Rica (San José); Nicaragua; Honduras; El Salvador; Guatemala; Quintana Roo; Oaxaca (Huajuapan); Guerrero (Coyuca); Baja California (Cabo San Lucas, Miraflores); and along the California coast to Eureka.

The range as outlined is for the entire species of which 12 subspecies are recognized. The northern yellowthroat (*G. t. brachidactyla*) breeds from southeastern Manitoba, central and northeastern Ontario, central and southeastern Quebec, and the southwestern half of Newfoundland south to western North Carolina and west to central and northeastern Oklahoma, Kansas, and central Nebraska; the Maryland yellowthroat (*G. t. trichas*) breeds from southern Pennsylvania south to northern parts of Georgia and Alabama, and to eastern Texas; the Florida yellowthroat (*G. t. ignota*) is a permanent resident in southeastern Louisiana, southern Mississippi, and Florida; the Athens yellowthroat (*G. t. typhicola*) breeds from southeastern Virginia to central Alabama; the western yellowthroat (*G. t. occidentalis*) breeds from central northern and southeastern Oregon, southern Idaho, southwestern Wyoming, central northern Colorado, southwestern Nebraska, and southwestern and central southern Kansas, south to central eastern California, south-central Nevada, central southern Utah, northern and central eastern Arizona, northern and central eastern New Mexico, and northern Texas; the Pacific yellowthroat (*G. t. arizela*) breeds along the Pacific coast in southeastern Alaska, to northwestern, central northern, and central California; the salt marsh yellowthroat (*G. t. sinuosa*) breeds in the salt-water marshes of the San Francisco Bay area of central western California; the Sonora yellowthroat (*G. t. chryseola*) breeds and is probably resident in southeastern Arizona, southern central and southeastern New Mexico, and western Texas, south to northeastern Sonora and northwestern Chihuahua; the tule yellowthroat (*G. t. scirpicola*) is a resident race in southern California, southeastern Nevada, southwestern Utah, and westernmost Arizona, south to northern Baja California; the Brownsville yellowthroat (*G. t. insperata*) is a resident race of the Rio Grande delta region below Brownsville, Texas; the San Blas yellowthroat (*G. t. modesta*) is a resident race along the western coast of Mexico from central western Sonora through Sinaloa and Nayarit to Colima; and the northern plains yellowthroat (*G. t. campicola*) breeds in southern Yukon, northeastern British Columbia, northern Alberta, south-central Saskatchewan, and southwestern Manitoba; south to southeastern Alaska, central Oregon, central Idaho, northeastern Colorado, and North Dakota.

Migration.—Late dates of spring departure are: Colombia—Lake Macotama, Santa Marta region, April 21; Baudó Mountains, near Nuqui, June 16. El Salvador—Lake Chanmico, May 17. Costa Rica—Basin of El General, May 2. Honduras—near Tela, April 28. Guatemala—near Quiriguá, May 7. Tabasco—Balancán, May 9. Puerto Rico—Desengano, April 18. Dominican Republic—May 8. Jamaica—Spanishtown, May 10. Cuba—Cienfuegos, May 12. Bahamas—May 10. Florida—Lower Florida Keys, May 21. Arizona—Tucson, June 7. California—Pasadena, May 20.

Early dates of spring arrival are: Bahamas—Cay Sal, March 13. Florida—Sombrero Key Light, March 3. Alabama—Greensboro and Shelby, March 11; Birmingham, March 14 (average of 10 years, March 17). Georgia—Savannah, March 12. South Carolina—Columbia, March 11. North Carolina—Raleigh, High Rock, and Washington, March 20 (average of 30 years at Raleigh, March 28). Virginia—Cape Henry, March 7 (average, April 7); Rockbridge County, April 18. West Virginia—Bluefield, April 14; French Creek, April 27 (average of 17 years, May 1). District of Columbia—Washington, April 11 (average of 57 years, April 22). Maryland—Baltimore and Patuxent Wildlife Research Refuge, April 12. Delaware—Kent and Sussex Counties, March 4 (average of 21 years, March 20). Pennsylvania—Carlisle, April 3; Kennett Square, April 15. New Jersey—Camden, April 3; Trenton, April 20. New York—Staten Island, April 10; Poughkeepsie, April 14; Watertown, April 22. Connecticut—Carrollton, April 25. Massachusetts—Woods Hole, April 17. Vermont—St. Johnsbury, May 1. New Hampshire—East Westmoreland, May 3. Maine—Waterville, April 18; South Harpswell, May 4. Quebec—Montreal, May 4. New Brunswick—Fredericton, April 30. Nova Scotia—Yarmouth, May 9. Newfoundland—St. Andrews, May 27. Louisiana—Bains, March 30. Mississippi—Edwards, March 10. Arkansas—Monticello, March 26. Tennessee—Nashville, April 6 (average of 12 years, April 8); Elizabethton, April 1. Kentucky—Bowling Green, April 8. Missouri—Pemiscot County, April 8. Illinois—Murphysboro, April 15; Chicago region, April 20 (average May 4). Indiana—Carlisle, April 17. Ohio—Oberlin, April 13; Columbus, April 17 (average for central Ohio, April 25). Michigan—Ann Arbor (University), April 17. Ontario—London, April 25; Ottawa, May 4 (average of 9 years, May 16). Iowa—Elkader, April 19. Wisconsin—Prairie du Sac, April 10; Madison, April 24. Minnesota—Lanesboro, April 30 (average of 40 years for southern Minnesota, May 9). Texas—White Rock, March 9. Oklahoma—Adair County, April 7. Kansas—Wichita, April 12. Nebraska—North Platte, April 18. South Dakota—Yankton, April 30. North Dakota—Devil's Lake region, May 3. Manitoba—Treesbank, May 13. Saskatchewan—Regina, May 7. New Mexico—San Antonio, March 28. Utah—Wendover, March 15. Arizona—Tucson Valley, February 29. Colorado—Colorado Springs, April 2. Wyoming—Douglas, April 16; Laramie, May 2 (average of 10 years, May 10). Idaho—Moscow, May 1. Montana—Fortine, May 9. Alberta—Banff National Park, May 5. California—San Clemente Island and Colorado River Valley, March 23. Nevada—Millett, April 26. Oregon—Jackson County, March 22. Washington—Yakima County, March 29. British Columbia—Courtenay, Vancouver Island, April 15.

Late fall departure dates are: Alaska—Taku River, September 9. British Columbia—Okanagan Landing, October 10; Comox, Vancouver Island, October 12. Washington—Bellingham, October 1. Oregon—Eugene area, October 18. Nevada—Indian Springs, Charleston Mountains, October 11. California—Coalinga, October 22. Alberta—Glenevis, October 8. Montana—Bozeman, October 8. Idaho—Moscow, October 4. Wyoming—Douglas, October 16; Laramie, October 12 (average of 7 years, September 18). Colorado—Boulder, September 30. Arizona—Tucson, November 11. Utah—Deep Creek, October 5. Saskatchewan—Eastend, September 28. Manitoba—Brandon, October 5; Aweme, September 26 (average, September 17). North Dakota—Fargo, October 18. South Dakota—Yankton, October 15. Nebraska—Hastings, October 8. Kansas—Lake Quivira, Johnson County, September 27. Oklahoma—Oklahoma City, October 16; Copan, November 29. Texas—El Paso, October 26. Minnesota—Hutchinson, October 26 (average of 14 years for southern Minnesota, September 27). Wisconsin—Mazomanie, October 18; Madison, December 21. Iowa—Osage, October 26. Ontario—Fort Albany, James Bay region, September 22; Ottawa, September 27; Hamilton, December 19; Toronto, December 25 and 26. Michigan—Erie, November

29; Sault Ste. Marie, December 1. Ohio—Toledo, November 23; Buckeye Lake, November 2 (average, October 14). Indiana—Bloomington, November 4. Illinois—Chicago, October 28 (average of 15 years, October 9). Missouri—St. Louis, October 19. Kentucky—Bowling Green, October 29. Tennessee—Elizabethton, October 27. Mississippi—Oxford, October 10. Newfoundland—Cape Anguille, October 3. Nova Scotia—Wolfville, October 4. New Brunswick—Saint John, October 15. Quebec—Montreal, October 14; November 29. Maine—Bath, October 21, November 10; Portland, December 8. New Hampshire—Hanover and Sandwich, October 22. Vermont—Rutland, October 23. Massachusetts—Cambridge, November 26; East Orleans, December 10. Rhode Island—Little Compton, November 5. Connecticut—Portland, November 7; West Hartford, November 12. New York—Rochester, October 28; numerous November and December records near the coast. New Jersey—Union County, November 24 (average, October 21). Pennsylvania—Renovo, October 24; Jeffersonville, November 1. Maryland—Baltimore County, October 27. District of Columbia—Washington, November 2 (average of 20 years, October 6). West Virginia—Bluefield, October 21. Virginia—Rockbridge County, October 21. North Carolina—Raleigh, October 24 (average of 8 years, October 13). South Carolina—Spartanburg, October 16. Georgia—Tybee Light, October 21; Demarest, November 30. Alabama—Birmingham, October 22 (average of 10 years, October 19).

Early dates of fall arrival are: California—Cactus Flat, San Bernardino Mountains, August 16. Arizona—Huachuca Mountains, August 25. Illinois—Chicago, August 21 (average, August 29). New York—New York City, August 13. Maryland—Patuxent Wildlife Research Refuge, August 12. Georgia—Tybee Light, September 23. Florida—Sombrero Key, September 12. Cuba—Cienfuegos, September 5. Dominican Republic—Ciudad Trujillo, September 30. Puerto Rico—Monte Grande, October 31. Yucatán—Chichén-Itzá, October 8. Honduras—near Tela, October 3. Nicaragua—Escondido River, October 28.

Egg dates.—Arizona: 11 records, May 30 to July 22; 7 records, June 1 to 9.

California: 66 records, April 4 to July 10; 33 records, May 1 to 20, indicating the height of the season.

Florida: 11 records, April 22 to July 20; 6 records, April 26 to May 7.

Massachusetts: 97 records, May 23 to June 27; 55 records, May 30 to June 8.

Nova Scotia: 9 records, June 4 to 26 (Harris).

GEOTHLYPIS TRICHAS IGNOTA Chapman

FLORIDA YELLOWTHROAT

Contributed by Alfred Otto Gross

Plate 69

HABITS

The Florida yellowthroat was first described by Frank Chapman (1890) based on an adult male in breeding plumage taken at Tarpon Springs, Fla., May 19, 1887. His description is as follows:

> Above olive green with a slight rusty tinge, somewhat lighter on the rump and tail; wings brownish, the feathers edged with the color of the back, the outer web of the first primary whitish, the carpal bend yellow. A broad black facial mask includes laterally the eyes, auriculars, and sides of the throat, reaching on the forehead to near the posterior margin of the eyes, and is bordered by a band of hoary ash, which has no abrupt posterior termination but, suffusing the crown, changes gradually into the color of the back. Under parts rich yellow, whitish on the centre of the abdomen; flanks rich ochraceous brown, the sides of the breast slightly washed with the same color. *Measurements:* Wing 2.26; tail, 2.32; tarsus, .84; exposed culmen, .50 inch. * * *
>
> *Adult female in breeding plumage.* * * * Similar in color to the male, but without the black mask and ashy border, the crown being rusty brownish, paler on the forehead. * * *
>
> *Adult male in winter.* Similar to adult male in the spring but darker above, the ashy band bordering the black mask restricted to a narrow line; crown rich rusty brown, brighter anteriorly, where also the feathers have more or less ashy and yellowish bases, and fading gradually into the color of the back; abdomen somewhat paler. * * *
>
> *Adult female in winter.* Similar to adult fall specimens of *trichas*, but darker above, with the yellow of the breast and underparts washed with brownish.
>
> *Immature birds.* Immature birds of both sexes are not readily distinguishable from wintering northern specimens, and from the nature of the case there are at this season specimens showing every degree of intergradation, both as regards size and coloration. Generally speaking the resident birds are slightly darker above, with the marking of the under-surface deeper in color and of greater extent.
>
> The Florida yellow-throat is similar to the Maryland yellow-throat, but with a longer tarsus, tail, and bill; yellow of underparts of a deeper shade and greater extent; flanks of a much darker color; the upper parts browner; the facial mask wider, with its ashy border (in summer specimens) slightly paler and of greater extent. First primary shorter, equalling the eighth instead of the sixth, as in the Maryland yellow-throat.

The breeding range of the Florida yellowthroat as formerly defined included the region from the Dismal Swamp region of Virginia, the coast of South Carolina, central Alabama, and central Georgia to Florida and along the Gulf coast to Louisiana. Since the Athens yellowthroat (*typhicola*) has been recognized, the breeding range does not extend farther north on the Atlantic coast than northern

Florida (Burleigh, 1937). In a later paper Burleigh (1944b) states the Florida yellowthroat has an extremely limited range on the coast of Mississippi. Specimens were taken every month of the year except July along a narrow southeastern coastal area but it was noted only once, during the summer, on any of the islands off the coast. Breeding birds taken only 22 miles inland north of Gulfport were found to be intermediate in their characters between the Florida and the Athens yellowthroat. The Florida yellowthroat breeds throughout Florida and is practically resident except in the more northern parts of its breeding range. Possibly a few migrate south of Florida to Cuba, since *ignota* as well as the two northern forms have been found dead at stations in southern Florida during the migration season.

According to Holt and Sutton (1926) it is abundant in all suitable places throughout southern Florida, but particularly numerous at " 'Gator Lake, in the salt-marsh inhabited by the Cape Sable Seaside Sparrows at East Cape, and along New River near Miami. Common also on the keys off East Cape." Frank M. Chapman (1907) writes: "In Florida this resident form of the Yellow-throat is so commonly found only in scrub palmettos that it is known as the 'Palmetto Bird.' I have also found it about the bushy borders of 'bay-galls' surrounded by scrub palmetto, while in the Kissimee region it lives in the lower growth (largely young palms) of cabbage palms." According to A. H. Howell (1932):

> The Florida yellow-throat inhabits thickets and brier patches, being especially partial to wet situations, such as the borders of streams, lakes, and sloughs. The birds are common along the canals in the Everglades, and in the floating vegetation on the upper St. Johns River near Lake Washington, and are found in smaller numbers in dry palmetto thickets on the prairies or in the forests. They are rather shy, and on being disturbed take refuge in the depths of the thickets in which they live, and voice their alarm with a characteristic burring *chink*. In singing they usually come out to the edge of the thicket or fly to a low perch on a bush or tree.

In winter the Florida yellowthroat is common about cultivated lands, in thick scrub and tall switch grass on the prairies and in grassy, marshy situations. Since there is no marked increase in spring, it is another indication that this form is not strongly migratory.

Nesting.—The nesting habits of the Florida yellowthroat are similar to those of the northern subspecies. It is interesting that it breeds as late in the season (April 10 to June 9) as do the birds in the middle Atlantic states. The nests are placed in clumps of grass in marshy situations and sometimes in weeds, bushes, and thickets on dry ground. They are loosely woven of dry grasses, stems, and bits of wide blades of swamp grass, and lined with fine grasses; they are seldom placed more than a few inches above the ground.

Eggs.—Most of the sets of eggs are four in number but a few with five eggs have been reported. The color and markings of the eggs are similar to those of the Maryland yellowthroat. The measurements of 29 eggs average 17.7 by 13.4 millimeters; the eggs showing the four extremes measure **19.2** by 13.5, 18.6 by **14.0**, and **16.1** by **12.4** millimeters.

Food.—The yellowthroat is said to be a very beneficial insect-eating bird in Florida, in regions where tomatoes and other vegetable produce is reared. But like the other subspecies of yellowthroats the majority of the birds occupy habitats where the destruction of insects is of less importance to agriculture.

The contents of the stomachs of seven yellowthroats collected in Florida were found by the United States Biological Survey to consist mainly of insects, with a few spiders and small mollusks and a small number of seeds of the sweetgale. Of the insects eaten, Orthoptera (chiefly grasshoppers) and crickets comprise the largest amount, with Hymenoptera (ants, wasps, bees) next in importance. Other forms well represented were beetles, bugs, flies, and caterpillars.

Voice.—The song of the yellowthroat as it is heard in Florida is full and strong, and while having the same characteristics, is nevertheless recognizably different from that of the northern yellowthroat we hear in New England. The song has been interpreted as *witcher-cheree, witcher-cheree, witcher-cheree*, but there is considerable individual variation in the renditions. The song may be heard throughout the spring and summer but in spring it seems to be more spirited and perhaps more elaborate.

The flight song begins as the singer launches forth from his thicket, reaches a climax at a height of 15 or 20 feet, when the head is thrown back as when singing at rest, and gradually dies away as the bird sinks down with rapidly vibrating wings. The flight song resembles the following: *Chee, chee, chee, chee, che-witchery, witchery, witchery, witchery.*

Enemies.—The Florida yellowthroat like that of its near relatives is subject to parasitism by the cowbird. It is seldom that the young of the yellowthroat survive more than a few days before they are starved or suffocated to death by the much larger and more aggressive cowbird.

Various observers have reported that it frequently falls prey to snakes, turtles, and even fish. This might reasonably be expected of individuals that frequent the swamps and marshlands of semitropical Florida where such enemies are abundant.

Harold S. Peters (1936) has found the tick, *Haemaphysalis leporis-palustrus* Packard a parasite of the Florida yellowthroat. It is of interest that he found no ticks infesting either the Maryland or the northern yellowthroats.

Since the Florida yellowthroat does not migrate to the extent of the northern yellowthroat it does not meet with the extraordinary hazards of a long migration which has been the cause of the death of so many of the northern species.

GEOTHLYPIS TRICHAS TYPHICOLA Burleigh

ATHENS YELLOWTHROAT

Contributed by Alfred Otto Gross

HABITS

The Athens yellowthroat bears a superficial resemblance to the Florida race but can be readily separated from it by its distinctly smaller bill, and less brownish under parts and flanks. The northern yellowthroat can be differentiated from the Athen's yellowthroat by its larger bill and olive green rather than brownish upper parts.

The Athens yellowthroat is distributed from southeastern Virginia to Georgia and Alabama and in migration to eastern Mexico. Burleigh (1937), in an account of the yellowthroats of Georgia, writes:

> The Athens yellow-throat is the most abundant of the yellow-throats occurring in the state, and in fact it is one of the most characteristic birds of Georgia. Except for the limited area occupied by the Maryland yellow-throat it can be found throughout the state, and, while less numerous during the winter months is to a large extent resident as far north as Athens. In severe winters it is perceptibly scarcer in the northern half of the state, but even with snow on the ground and the temperature well below freezing an occasional bird can be seen in the thickets and stretches of underbrush. All winter records based on actual specimens taken have without exception been found to refer to this race alone.

Specimens of the Athens yellow throat were previously referred to the Florida yellowthroat, a race, as now restricted, that is confined largely to the peninsula of Florida and the coastal regions of southeastern Georgia.

The nesting habits and behavior of the Athens and Florida yellowthroats are similar.

GEOTHLYPIS TRICHAS OCCIDENTALIS Brewster

WESTERN YELLOWTHROAT

Contributed by Alfred Otto Gross

HABITS

The western yellowthroat is a large form of *Geothlypis trichas* first described by William Brewster in 1883 (Allen and Brewster, 1883). An adult male collected at Truckee River, Nev., May 4, 1881, was described as follows: "Upper parts nearly uniform pale yellowish-olive, with a tinge of brown on the occiput; throat, jugulum, breast, anterior portion of abdomen, and under tail-coverts rich, pure yellow; sides of body warm ochraceous brown strongly tinged with yellow; middle of abdomen anteriorly creamy white; a black mask on the front and sides of the head bordered behind by a broad band of creamy white, slightly tinged with bluish; much concealed yellow on the feathers of the crown." In comparing *G. trichas occidentalis* with *G. t. trichas* he states it "is somewhat larger * * * and its tail is disproportionately longer. Its upper parts always paler and usually yellower; the yellow of the under parts is decidedly richer and purer, and extends much farther down on the abdomen, frequently tinging nearly all of the body beneath; the flanks are paler and more ochraceous; the white of the head purer and generally broader."

W. Palmer (1900) in comparing the western with the northern yellowthroat states:

> The western bird, *occidentalis*, is a little larger than *brachidactyla*, but grayer in dorsal coloration with a broad white posterior edging of the facial black. The yellow of the throat is more intense and the black of the forehead is relatively narrower. Freshly molted adult birds are but slightly paler dorsally than eastern birds, but immature birds are fully as dark and as brown above as in similar aged eastern birds. The females in summer are as a rule less yellowish and paler than eastern birds. A few have decidedly yellow throats but it is far from the rule. The immature females are browner and duller above and beneath with a much browner tinge across the breast than in either *trichas* or *Brachidactyla.*

The wing formula and the relative length of the primaries exhibit distinct differences from those of the eastern forms.

The western yellowthroat breeds from Oregon, southern Idaho, and the western portion of the Great Plains (North and South Dakota and Texas) south to northern New Mexico. The distribution of the western yellow-throat in California where there are also the two forms *G. t. sinuosa* and *G. t. scirpicola* represented, is complicated. According to Grinnell and Miller (1944) : "In breeding season, valleys of northern California from the coast east to the Nevada line; in central California south to northern Sonoma County, thence east of San Francisco Bay through Solano and eastern Contra Costa counties to the Monterey Bay area and the Salinas Valley; extends south into central San Joaquin Valley where intergradation with *scirpicola* takes place; similarly east of the Sierra Nevada intergradation becomes apparent in Owens Valley, Inyo County."

In winter the western yellowthroat is found in the Sacramento and San Joaquin Valleys, Calif., from Tehama County southward to southern California, and through Baja California and western Mexico as far south as Cape San Lucas and Tepic, Nayarit. In California migrants appear in all sections of the State, even up the middle elevations in the mountains.

Specimens of the western yellowthroat have been taken as far east as Erie, Mich. (Van Tyne, 1944), and Gulfport, Miss. (Burleigh, 1944).

In Washington, according to correspondence from Samuel F. Rathbun, the western yellowthroat is decidedly localized in its distribution, being restricted to brushy borders of swamps, marshes, lakes, and streams, but very often it is absent from these localities. When seen among the rushes along the edge of some rush-bordered piece of water, climbing actively among the stalks, its actions are reminiscent of those of the tule wrens.

At Fort Klamath, Oreg., J. C. Merrill (1888) writes: "The habits of the Western Yellow-throat in this vicinity, as regards its favorite resorts, are quite unlike what I have elsewhere observed. Though the numerous streams offer it the same rank undergrowth along their swampy edges that it in other places prefers, yet it is rarely seen in such situations. A few are found among the low willows growing in the marsh, but its favorite haunt, and one in which it is very common, is among the tules in company with Marsh Wrens and Yellow-headed Blackbirds."

In California, Grinnell and Miller (1944) state that its habitat is in the "low thick tangles of plant growth in or about fresh- or brackish-water marshes and sloughs; extremely small areas of flooded ground in river bottoms * * * may suffice. Important is continuous cover for concealment in foraging down to the mud or water surfaces. The sphere of activity is within six feet of the water and principally within three feet."

In Montana, according to A. A. Saunders (1921) the western yellowthroat is—

> a very common summer resident in the western half of the state, east to the western part of the prairie region. Apparently rare in the more eastern part of the prairie region, and occuring there only in migration. Breeds throughout the Transition zone, on the prairies, and in the mountain valleys and foothills. Nests in thickets of willow, wild-rose and similar shrubs, in moist places along the streams. The breeding range of the Western Yellowthroat in Montana is almost exactly coincident with that of the MacGillivray Warbler, both being found east of Fergus County and the Musselshell River, but the Yellowthroat is much commoner at low elevations in valleys, and much less common in the mountain foothills. In many localities, however, the two species are found together.

In Utah where the western yellowthroat is a common resident, except in the southwestern part of the state, W. H. Behle (1944) writes:

"[it] occurs in cattail and tule marshes and in willow-cottonwood association bordering valley streams."

Nesting.—In his Birds of California, William Leon Dawson (1923) writes:

> Nests of the yellow-throats are the commonplace of all swampy localities—commonplace, yet never without interest, because of their varied architecture and their diverse setting. A nest may be sunk firmly into a tussock of grass barely clear of the ground or water, or it may be lashed firmly to stalks of an investing clump of cattails, or it may be deftly hidden under a canopy of weed-tops a hundred feet from water. The nest may be composed chiefly of brittle weathered leaves or grass or sedge, so coherent as to be scarcely removeable, or else it may be settled into a veritable fortress of coiled cattail leaves sturdy and dependable. The lining too, may be of coiled grasses almost as light in color as the speckled white eggs which they support, or it may be of black horsehair, throwing the jewels into prized relief.

Grinnell and Miller (1944) write: "nests are placed low down, often over the water. Plant associations most likely to meet these requirements: growths of cattails, tules and other sedges, especially where tangled and matted; thickets of young willows; blackberry vines, accompanied by nettles and dock."

A nest collected at Fairbank, Ariz., is described by A. C. Bent (MS.) as follows: "Bulky, loosely built nest made up entirely of coarse strips of sacaton grass and other grasses; no plant down or other soft material. The dimensions were, outer height 3 inches, diameter 4½ inches, inner depth 2 inches and inner diameter 2¼ inches."

W. L. Dawson (1923) states the nest is "of course coiled grasses, or, more rarely, leaves of *Typha angustifolia;* lined with fine grasses or horse hair." Others have mentioned that a lining of horsehair is sometimes used, as is also the case of many nests built by the eastern forms of the yellowthroat.

Eggs.—The eggs vary from three to five in number but the majority of the nests contain four eggs. They are similar in their markings to those of other forms of yellowthroat, having a ground color of white or creamy white, dotted and spotted or rarely streaked with black, shades of brown, and lavender or vinaceous gray. The markings are usually concentrated about the larger end of the egg.

Food.—F. E. L. Beal (1907) in an investigation of the food of the western yellowthroat examined the contents of 114 stomachs of birds taken in California during every month but January. He found the yellowthroat to be practically wholly insectivorous and the insects it eats to be either harmful or of little economic value. It eats no fruit or grain, or, as far as known, any other useful product. Beal states further:

> The animal matter amounted to 99.8 percent of the total food. The largest item is Hymenoptera, amounting to 35 percent, of which about half is ants and the remainder wild bees, wasps, etc. Hemiptera amount to 28 percent, and are

> made up of leaf-bugs, leaf-hoppers, tree-hoppers, plant lice, scales, and probably some others not identifiable. The black olive scale was found in a few stomachs and plant-lice in one, but the other families were a pretty constant component of the food in every month. Beetles were eaten to the extent of nearly 15 percent, and are mostly harmful species.—The three orders of insects [Hymenoptera, Hemiptera, and Coleoptera] mentioned above form the greatest bulk of the food of the yellowthroat, and are regularly eaten throughout the year.

Caterpillars and moths comprise 5 percent, Diptera 12 percent, spiders 4 percent. Grasshoppers were found in four stomachs.

The vegetable food was incidental and was probably taken accidentally when other food was being secured. It consisted of only a few seeds and vegetable rubbish.

Voice.—The song of the western yellowthroat is similar to that of the eastern forms but William Leon Dawson (1923) has presented some interesting and unusual interpretations as follows:

> Mounting a weed-stalk, he rubs out, *Rees'iwitte, rees'iwitte, rit,* or *I beseech you, I beseech you, I beseech.* Rhythm is the chief characteristic of this song, and although a given bird appears to be confined to a single type, the variety of feet offered by a swamp is most entertaining. *Chit'ooreet, chit'ooreet chu';* heard on the edge of a northern pond, reminded me of the Kentucky warbler (*Oporornis formosus*); while another, less ambitious, lisped, *O-tis twiss'-pe, o-tis twiss' pe.* Returning to the typical rhythm, one indignant swain near Los Angeles, shouted, *Greas'y wittles, greas'y wittles, grit!* * * *
>
> But by far the most remarkable song in my experience came from a locality in eastern Washington. We had just been listening to the unwonted notes of a Desert Sparrow * * * some hundreds of miles out of its usual range, and we were not unprepared for shocks, when *Hoo hee, chink i woo chu tip* fell upon our ear. Again and again came the measured accents, clear, strong and sweet. Not till I had seen the mandibles of a Western Yellow-throat, and that repeatedly, moving in perfect rhythm to music, could I believe so small a bird the author of this song. For fifteen minutes the Warbler brought forth this alien strain, *Hee-o chiti wo, chu tip,* or *Hee oo chitiwew chu tipew,* without once lapsing into ordinary dialect.

Mr. Dawson also describes a harsh accusing note uttered by the western yellowthroat which he describes as "a sort of Polish consonantal explosion, *wzschthub,*—a sound not unlike that made by a guitar string when struck above the stop."

Richard Hunt (1919) describes and presents an excellent analysis of the song of the western yellowthroat he heard on the campus at Berkeley, Calif., as follows:

> As I listened from an office window, a single clear and near example of the song reached my ears. It was an utterance in four sections, the first three being four syllabled and exactly alike: *pritisitta, pritisitta, pritisitta, prit,* with accent on the *prit.* I had never heard a Yellowthroat song of this exact syllabification, but the chief and important distinguishing character of the song of the species is, after all, its exact repetition of some sort of two- or three- or four-syllabled word. Every individual Yellowthroat has quite a stock of different words, and some are likely to be different from any words one would hear another individual sing. Timbre, to be sure, is also a character of the Yellowthroat song—

though it varies among and in individuals as widely as does the word-form. The timbre of this song was hardly typical: it was unusually loose and liquid. The utterance was comparatively slow.

Samuel F. Rathbun writes that in Washington the western yellowthroat sings from the time of its arrival, during the last week of April, until nearly the end of July.

Like its eastern relatives, the western yellowthroat has a characteristic flight song which has been noted by various observers but I have seen no published accounts of the details of the performance.

Enemies.—The western yellowthroat is frequently parasitized by the cowbird, and several writers claim that it is one of the most frequent victims in their respective localities. The records range from Colorado to Utah, the latter probably referring to the sagebrush cowbird. In California this yellowthroat has been reported as being parasitized by the dwarf cowbird.

While the yellowthroat resides in a habitat where it would not be expected to be molested, nevertheless, according to various reports, it is often a victim of predatory birds. W. L. Finley (1907) relates an experience in which a Cooper's hawk attempted to strike the birds he was observing.

Migration.—The dates of migration of the western yellowthroat seems to vary greatly in different parts of the west, depending on the altitude, climate, and temperature of the regions traversed. W. W. Cooke (1904) states: "The birds arrive at just about the same time—second week in May—on the plains of north-central Colorado and at Great Falls and Columbia Falls, Mont., the latter place almost 600 miles farther north, but enjoying at this period of the year an equal degree of warmth with the Colorado plains. But almost a month earlier than this, southern British Columbia is reached by the yellowthroats that wintered in the warm valleys of California lying as far north as the plains of north-central Colorado which during the winter season can support no warbler life."

It is difficult to follow the migration of the western yellowthroat, as it passes through regions where it is resident and where other subspecies are also resident. In Arizona it is a common migrant in April and May (throughout May at Shiprock, N. Mex.) and has been reported at Rinconada May 5, 1904. It has been recorded as late as May 10 at Ortez, Sonora, Mexico. Spring dates in California are: Colorado River Valley and San Clemente Island, March 23; Pasadena, March 25; Berkeley, May 21; and Yosemite Valley, May 25. The western yellowthroat arrives in Oregon during April, the earliest date for Jackson County is March 22 and the earliest date for Lake County is April 9. In Washington it reaches Seattle April 17–21; Hoquiam, April 27; Ocosta, April 30; Tacoma, April 6–12; and Yakima County, March 29.

Migration in the autumn begins in August and continues through October. There are numerous winter records of the western yellowthroat in California, so that fall as well as spring records mean little in following migration. It has been recorded at San Bernardino Ranch, Sonora, Mexico, August 26 to September 8, 1892; and at San Pedro River, October 7 to 15, 1892.

GEOTHLYPIS TRICHAS CAMPICOLA Behle and Aldrich

NORTHERN PLAINS YELLOWTHROAT

Contributed by James Lee Peters

HABITS

The breeding yellowthroat of the northern Rocky Mountains and northern Great Plains region was named by Behle and Aldrich (1947) who characterized the race as follows:

> Similar to *Geothlypis trichas occidentalis* of the Great Basin, but upper parts grayer, less yellowish olive green; yellow of underparts less extensive posteriorly; belly and flanks grayer, averaging more whitish, less buffy. Similar to *G. t. arizela* of the humid coast belt west of the Cascade Range, but also grayer on upper parts; white frontal stripe broader; yellow of under parts slightly paler and less extensive; posterior underparts whiter, less buffy. The range assigned to this race by its describers is as follows: "Breeds east of the Cascade Mountains in northern Oregon, Washington, and British Colombia, thence east through northern Idaho, Alberta, Saskatchewan, Montana, northern Wyoming to northern North Dakota. In migration occurs southward in Utah, Colorado, and Arizona. Winter range undetermined.

GEOTHLYPIS TRICHAS SINUOSA Grinnell

SALT-MARSH YELLOWTHROAT

Contributed by Alfred Otto Gross

HABITS

The salt-marsh yellowthroat is known also as the San Francisco yellowthroat because of its restricted distribution chiefly in the region about that city. This form was described by Joseph Grinnell (1901) as follows: "Similar to *Geothlypis trichas occidentalis*, but dorsally and laterally darker in color, and size much less. Thirteen specimens (males) from the marshes of San Francisco Bay measure: Wing 51 mm. to 54.6 mm. averaging 53 mm.; tail 52.6 to 56.6 mm. averaging 55 mm."

Grinnell and Miller (1944) give an account of its status, range, and habitat as follows:

> *Status*—Resident; but to some degree scatters or migrates from breeding range in San Francisco Bay region to appear, fairly commonly, as a winter visitant

in southern California from late September to mid-March. Common throughout year on breeding grounds.

Geographic range—In breeding season vicinity of San Francisco Bay, Marin County, and Napa sloughs, southern Sonoma County, on the north, east to Carquinez Strait, and south to vicinity of San Jose, Santa Clara County. In winter, coastal marshes from San Francisco Bay region south to San Diego; also, twice recorded north to Humbolt Bay. Life-zones, Upper Sonoran and Transition; localities of nesting all below 1,000 feet elevation. * * *

Habitat—In summer, fresh and salt water marshes, but chiefly the former. More commonly found near salt and brackish water in fall and winter. Requires plant cover similar to that frequented by the race *Geothlypis trichas occidentalis* [the western yellow-throat]. * * * Tall grasses, tule patches and willow thickets provide normal plant environment for nesting activity.

Milton S. Ray (1916) found three nests of the salt-marsh yellowthroat in the Lake Merced region of San Francisco County on April 22, 1911. Two of the nests had four eggs each in advanced stages of incubation and one contained three fresh eggs. All three nests were about two feet up in wiregrass and were made of coarse flat weed stems lined with fine light-colored grasses, loosely put together. Mr. Ray states this yellowthroat does not inhabit the salt marshes exclusively but is much more abundant along fresh-water lakes and streams and in wet meadow land. However, one nest with 4 eggs was found in a salt marsh north of San Rafael on April 12, 1914. This nest was on high ground not subject to overflow. An excellent account of the nesting habits of the salt-marsh yellowthroat in the Lake Merced region has been written by G. W. Schussler (1918), as follows:

The nesting period ranges from middle April until June, fresh eggs having been taken on April 2 and June 18. The yellowthroats, habitually suspicious, become doubly vigilant during the breeding season and I think only twice in all the years I have studied them have I surprised the female in the act of carrying nesting material. It has been my experience that if any unfinished structure not containing eggs is located, the birds promptly abandon it. The nest, a cup-shaped, fairly compact receptacle is usually composed of lengths of dried grass well interwoven with the supporting stems. It is commonly hidden in bunches of wire grass or weeds among willows and placed from six to twenty-four inches above the ground. The bowl-like interior is often lined in rather a loose manner with dried grass or thin fiber. The usual complement is four though a set of three, particularly when laid late in the season, is not rare. The eggs are taperingly oval in shape, white, with a decided pink tinge when fresh, and circularly splotched about the larger end with dots and dashes of black, brown, and deep lavender, varying in size from minute markings on some specimens to a pronounced ring of color on others. Incubation, which is performed by the female, usually occupies about fourteen days.

While incubating, the females show remarkable shyness in slipping off the nest and keeping well ahead of the observer, with short undulating flight. Occasionally as evening approaches they are apt to flush from directly beneath one's feet, particularly should he beat quietly up toward them against the wind. When startled from her nest the female disappears and maintains silence for some moments but if the intruder remains in the vicinity, or removes the nest or eggs, her sharp *chack* of alarm will rapidly summon the male and the pair will flit nervously about in the underbrush, often fearlessly approaching within a few yards of the observer.

The young when hatched are naked, but gradually become sparsely covered with light down. Feeding, which is participated in by both parents, takes place at short intervals during the greater part of the day, until the young are ready to leave the nest. So far as I have been able to observe, the parent birds appear to entice the ambitious nestlings into the tule and willow thickets away from the open flats where they may have been hatched. This is probably in order to afford them the shelter of the branches and, by removing them some little distance from the ground, to protect them against small predatory mammals.

[Author's Note: The measurements of 28 eggs average 17.1 by 13.2 millimeters; the eggs showing the four extremes measure **18.5** by 13.5, 18.2 by **13.8**, **15.9** by 12.9, and 16.3 by 12.4 millimeters.]

Voice.—G. W. Schussler (1918) states that in the winter the saltmarsh yellowthroats are in the seclusion of the high tules standing in deep water. At this season the birds flit out of sight in advance of one's approach, uttering their solitary *chack* of protest and suspicion. With the approach of spring they leave the tules to make incursions into the shorter grasses and among the willows. At this period Mr. Schussler has heard them utter a short grating call resembling *k-r-r-r-r-r* in addition to their familiar *chack*. He writes of the song as follows:

> It is usually not until some warm, sunny morning in late February that the clear ringing *wreech-ity wreech-ity, wreech-ity, wreech-ity* of the male is heard. The song varies considerably with the season and individual, those in early spring often sounding sadly out of tune, and some are even rendered in a condensed form of two syllables; but the power of it rises rapidly as the year advances until by the end of March its nuptial gladness pours forth in full-throated volume. Sometimes as evening approaches, one of the little black-faced birds will leap into the air with fluttering wings and expanded tail and as it slowly tumbles down into the grass again, will execute an exquisite series of melodious runs and trills not unlike the vocal accomplishments of the chat.
>
> In September the summer songs of the males have ceased and a great diminution in their numbers is noticeable. By November, *sinuosa* has again largely retired to the tule jungle and with his added winter air of distrust is once more the shy flitting figure of the December marshlands.

GEOTHLYPIS TRICHAS CHRYSEOLA Van Rossem

GOLDEN YELLOWTHROAT

Contributed by Alfred Otto Gross

HABITS

The golden yellowthroat was described from a breeding adult male, taken June 12, 1929 at Saric, north-central Sonora, Mexico, by A. J. Van Rossem (1930), who says of its subspecific characters: "Compared with *Geothlypis trichas scirpicola*, both sexes are brighter and more yellowish above, the yellow of the underparts is brighter and more extensive (the flanks of the males are only slightly, or not at all, tinged with grayish), and the post-frontal white band in the males is even wider and is noticeably suffused with yellow." Its range, he says, is "north-central Sonora, northeast to the San Pedro River in Cochise County, Arizona; east to northwestern Chihuahua and south, in spring at least, to Tecoripa, east-central Sonora."

Three of the four localities from which the Sonora yellowthroat is known indicate an upland habitat, and its range, when finally worked out, will probably be found to center in the northern part of the Mexican plateau.

Van Rossem (1945), speaking of Mexico, writes: "Evidently a fairly common resident in suitable localities along fresh water streams from the vicinity of Rancho La Arizona (and very probably from the Altar River valley) eastward across the northern part of the State nearly or quite to the Chihuahua boundary. The southernmost breeding station known at the present time is Pilares in the Bavispe River valley. * * * One specimen taken at Tecoripa, March 3, 1929, indicates a seasonal movement by part, at least, of the population."

Monson and Phillips (1941) state that *chryseola* is common at Feldon, Ariz., and that birds taken at Tucson and Bisbee are of this race. Burleigh and Lowery (1940) collected a male 10 miles east of Guadalupe Peak, Tex., at an elevation of 4,500 feet in an arroyo in the open desert on April 29, 1939. Sutton and Burleigh (1939) collected a male several miles north of Victoria, northeastern Mexico on February 25, 1938.

GEOTHLYPIS TRICHAS SCIRPICOLA Grinnell

TULE YELLOWTHROAT

Contributed by Alfred Otto Gross

HABITS

The tule yellowthroat was described by Grinnell (1901) as "similar to *Geothlypis trichas occidentalis*, but brighter colored and larger throughout with especially longer tail. Twenty-five males from the Pacific slope of Los Angeles County measure: Wing, 55 mm. to 60.3 mm. averaging 57 mm.; tail, 56 mm. to 64 mm. averaging 60 mm. *Scirpicola* is the brightest and deepest colored of all [the western yellowthroats], the yellow of the under parts being more extended posteriorly and having a hint of an orange tint, while the upper parts are brighter brown or green according to age and wear." A. J. Van Rossem (1930), in comparing the tule with the western yellowthroat, states that it has a brighter coloration and a slightly larger bill. "In *scirpicola* the dorsal plumage is greener (less grayish); the yellow of the underparts extends farther over the abdomen and is, in a series definitely brighter; the flanks are more brownish (less grayish) and the post-frontal band of white in the males is wider."

The range of the tule yellowthroat "extends along the Pacific slope from about 30° in Lower California north to Santa Barbara, California, the southern San Joaquin Valley and Walker Basin on the south fork of the Kern River. The Colorado River drainage colony which is (apparently) isolated from that on the Pacific extends from the mouth of the Colorado River north along that stream, and its tributary the Virgin River, to Washington, Washington County, Utah, west through the Imperial Valley to Mecca, Riverside County, and east up the Gila and Santa Cruz rivers at least to Tucson, Arizona." In California, according to Grinnell and Miller (1944), the altitudes of occurrence are chiefly below 1,500 feet, but birds may range up to 4,200 feet, as at Julian, San Diego County.

The measurements of 40 eggs average 17.3 by 13.3 millimeters; the eggs showing the four extremes measure **18.9** by 12.5, 18.0 by **14.0**, and **16.0** by **12.5** millimeters.

The ecology and nesting habits of the tule and western yellowthroats are similar.

GEOTHLYPIS TRICHAS ARIZELA Oberholser

PACIFIC YELLOWTHROAT

HABITS

Some fifty years after it was originally described, the Pacific race was officially admitted to the A. O. U. Check-List as a recognizable form.

The original describer, Dr. Harry C. Oberholser (1899) gives a detailed description of the type, an adult spring male from Fort Steilacoom, Wash., and writes: "From *occidentalis* the present race may be readily distinguished by its much narrower white frontal band, and also by its appreciably smaller size; though the former character is of course not available for determination of females and young. It differs from *trichas* as does *occidentalis*, but in dimensions not to so marked a degree. Intermediates between *trichas* and *occidentalis* such as occur on the Great Plains, come sometimes rather close to *arizela*."

He gives for this form the following distribution: "Pacific coast region from southern British Columbia to northern Lower California; east to the Cascade Mountains and the west slope of the Sierra Nevada; south in winter to Cape St. Lucas and Tepic."

GEOTHLYPIS TRICHAS INSPERATA Van Tyne

BROWNSVILLE YELLOWTHROAT

CONTRIBUTED BY ALFRED OTTO GROSS

HABITS

The Brownsville yellowthroat was described by Josselyn Van Tyne (1933) from an adult male secured in the Rio Grande Delta below Brownsville, Tex., on June 11, 1930:

> Subspecific characters.—Similar to *Geothlypis trichas trichas* (Linnaeus) but bill larger, forehead more whitish, and general coloration paler. Compared with *Geothlypis trichas occidentalis* Brewster it is smaller (wing of male 55–56 mm. instead of 55–60 mm.) but has a larger bill. The belly and flanks are more whitish, but the forehead is less extensively white. Compared with *Geothlypis trichas brachidactyla* (Swainson) it is paler and has a shorter wing but an even larger bill. The ninth primary of *insperata* is shorter than the fourth, instead of longer as in *brachidactyla*. Two juveniles of the new form, taken June 2 and 4, are much paler and have larger bills than any of a series of *brachidactyla* with which I have compared them.
>
> *Geothlypis trichas insperata* has the ninth primary shorter than the fourth, as in *Geothlypic trichas ignota* Chapman, but is much paler and has a very much larger bill. The larger bill alone is sufficient to separate *insperata* from the Pacific coast forms.

The Brownsville yellowthroat is known only from the type locality. It leaves the region during the winter but its winter home is not at present known, nor is anything known of its nesting habits.

GEOTHLYPIS TRICHAS MODESTA Nelson

SAN BLAS YELLOWTHROAT

CONTRIBUTED BY ALFRED OTTO GROSS

HABITS

The San Blas yellowthroat was described by E. W. Nelson in 1900. The description of a male taken at San Blas, Tepic, Mexico, June 12, 1897, is as follows: "Smaller than typical *G*[*eothlypis*] *trichas* from the eastern United States, with the green of back darker, more brownish olive and brownish flanks; black frontlet and white border to same nearly as in *Geothlypis trichas occidentalis*. * * * The young as well as the adults are distinguishable by their dark color."

A. J. Van Rossem (1930) states: "In typical form *modesta* is a dark colored race. It is much like *Geothlypis trichas sinuosa* of the San Francisco Bay region, but is slightly grayer (less olive) and has a longer tail and decidedly larger bill." Were it not for the larger bill it would be difficult to distinguish these two races, although their ranges are separated by a gap of over a thousand miles.

The San Blas yellowthroat is resident in a narrow strip of Tropical Zone salt-water associations of western Mexico, from southern Sinaloa northward to Tepopa Bay, and is accidental in Baja California (Magdalena Bay and San José Island). Its typical habitat is the mangrove–salicornia association. Nothing is known concerning its habits and nesting.

GEOTHLYPIS BELDINGI BELDINGI Ridgway

BELDING'S PENINSULAR YELLOWTHROAT

HABITS

This large handsome yellowthroat was discovered in southern Baja California in 1882 by that famous naturalist Lyman Belding, and was named for him by Ridgway (1882). It is considerably larger and much more richly colored than the yellowthroats of the *G. trichas* group. Belding (1883) found it "common in the few suitable localities around San José, Miraflores, and cañons of the Miraflores and Santiago Peaks."

Walter E. Bryant (1890b) found it on the west coast "at lower Purisima cañon, and as far north as San Ignacio." He says that "the birds kept mainly within the bullrushes and bushes of the creek," at Comondú on the east coast.

William Brewster (1902) writes: "Mr. Frazar saw his first Belding's Yellowthroat on April 21 at Triunfo, in a small, deep arroyo where the stream had been dammed for irrigating purposes, making a little pool of water around which grew a quantity of canes and rank grasses, the whole covering an area of about forty yards square. Here were found three pairs, the females of which were apparently incubating, although no nests were discovered. The species was next met with at San José del Cabo, where it proved to be one of the most abundant birds. It was also very common about the lagoon at Santiago, frequenting rushes, often where the water was three or four feet deep."

Nesting.—Bryant (1890a) was the first to find and positively identify the nest of Belding's yellowthroat. He found, or had shown to him, five nests near Comondú in 1889. A nest found on March 25 is thus described:

"The nest was loosely woven in a clump of 'cat-tails' (*Typha*) one metre above running water. It is composed outwardly entirely of dry leaves of the 'cat-tail,' and thinly lined with fine fiber and a few horsehairs. It measures externally (as nearly as can be determined from its rough shape) not less than 150 mm. in height by about 115 mm. in diameter. The receptacle is about 55 mm. in depth, with a diameter at the top of 50 mm. The general appearance is almost identical with some song sparrows' nests." Another nest, found on March 27, was in a similar situation but was only half as high. And a third was found on March 28, "in a heavy growth of 'cat-tails' near the outer edge of the clump, and placed one and one-half metres high. This nest, like the others, is composed of 'cat-tail' leaves, but is lined almost exclusively with black horsehairs, so few being used that they do not even hide the structural material." It should be noted that the birds breeding near Comondú are somewhat intermediate between the two races, but, as we have no nesting information from the Cape region, it seems best to include these quotations here.

Eggs.—Two or three eggs seem to make up the set for Belding's yellowthroat; 3 seems to be the commonest number. The 12 eggs in the Thayer collection are ovate and slightly glossy. The ground color is white or creamy white, which is rather sparingly speckled, spotted or blotched with "light vinaceous-drab," "light mouse gray," "pale brownish drab," or "Quaker drab," with fewer spots of "Hay's brown," "Dresden brown," or black. The markings are generally concentrated at the large end, often leaving the small end immaculate. The wreath, which may be made up of fine, dense specklings or spots, often has over-writings of black which circle the egg. The measurements of 32 eggs of the species, some of which may be intermediate between the two races, average 19.5 by 15.0 millimeters; the eggs showing the four extremes measure **21.0** by **16.0, 18.0** by 14.5, and 20.1 by **14.0** millimeters (Harris).

Plumages.—Brewster's fine series probably illustrates all the regular plumages of this yellowthroat. He (1902) describes the juvenal plumage from a specimen taken on September 5, just before the postjuvenal molt, as follows: "Above dull brownish drab, the wings faintly, the tail distinctly, tinged with olive; greater and middle wing coverts edged and tipped with rusty, forming obscure wing bands; below pale brownish buff, deepest on the sides, abdomen, and upper portion of the breast, unmixed with yellow save on the chin, where there are a few bright yellow feathers, evidently those of the first winter plumage; bend of wing slightly yellowish; under surface of wing ashy white; lores with a faint yellowish tinge."

This and other specimens indicate that the postjuvenal molt of the body plumage and the wing coverts occurs in late August and September. The male in first winter plumage differs from the adult "only in having the feathers of the black mask slightly tipped with grayish or yellowish, especially on the forehead; the yellow border of the mask more restricted and mixed with brownish; the breast and under tail coverts tinged with brownish saffron; the flanks and sides rich purplish cinnamon." The female in first winter plumage differs from the adult female in autumn "only in having the upper parts tinged with reddish brown, the throat and breast with brownish saffron, the flanks and sides, as well as the anal region, with cinnamon."

The series indicates that the spring plumage is acquired mainly, if not wholly, by wear in both young and old birds; and there is probably a complete postnuptial molt in late summer. He describes the adult male in fall as "differing from the spring male in having the yellow of the crown paler and tinged with grayish white; the upper parts of a deeper, browner olive, tinged slightly on the occiput and nape with purplish brown; the yellow of the under parts richer with more decided brownish on the sides and flanks; the base of the lower mandible flesh colored; the remainder of the bill dark horn colored instead of black. The black mask is wholly unmixed with any lighter color." The adult female in autumn differs "from the spring female only in being slightly grayer above."

Voice.—Bryant (1890) writes: "I frequently heard them singing, sometimes in the top of a low tree. Their notes are rather loud and quite clear, an interval of a few seconds occurring between each song. The three songs which I heard sung by the same individual March 31, were noted on the spot. In different places of the song occurred a low, short buzz, represented by stars in the following. The first song occupied about five seconds.

1. *Sweet, sweet* * * * *ear* * * * *sweet, sweet ear* * * * *sweet, sweet ear.*
2. *Sweet, sweet ear* * * * *sweet, sweet ear.*
3. *Sweet, sweet ear* * * * *sweet, sweet ear* * * *."

According to Brewster (1902), Frazar told him that "the song resembles that of the Maryland Yellow-throat, but is so much heavier and fuller that it can be easily recognized." Brewster says further that the bird occasionally mounts into the air and sings on the wing.

DISTRIBUTION

Range.—Resident in the southern half of Baja California.

Breeding range.—The peninsular yellowthroat is resident in Baja California from San Ignacio south to San José del Cabo. Two subspecies are recognized; Belding's peninsular yellowthroat (*G. b. beldingi*) is found only in the extreme southern part of the peninsula (Todos Santos, Triunfo, Santiago, Miraflores, and San José del Cabo); Goldman's peninsular yellowthroat (*G. b. goldmani*) occupies a range in central Baja California (San Ignacio, Santa Igueda, San Joaquin, Purissima, and Comondú).

Egg dates.—Baja California: 9 records, March 25 to May 17; 4 records, May 2 to 9.

Mexico: 6 records, April 9 to June 1; 3 records, May 4 to 18, indicating the height of the season (Harris).

GEOTHLYPIS BELDINGI GOLDMANI Oberholser

GOLDMAN'S PENINSULAR YELLOWTHROAT

Plate 70

HABITS

Dr. Harry C. Oberholser (1917) described the more northern race of *beldingi*, Goldman's peninsular yellowthroat, from the central portion of Baja California, as—

> similar to *Geothlypis beldingi beldingi*, but male with the upper surface much duller, more brownish or grayish (less yellowish) throughout; crown behind the black mask largely or wholly grayish or whitish instead of yellow; yellow of under parts somewhat lighter and confined to throat and breast; lower abdomen white or whitish, instead of usually deep yellow, as in *Geothlypis beldingi*; sides and flanks paler and more grayish. Female similar to the female of *Geothlypis bellingi*, but upper parts and sides of head paler, more grayish (less yellowish); yellow of lower parts paler and less extensive, confined to throat and upper breast, the abdomen being dull whitish, slightly or not at all washed with yellow; sides and flanks paler, more grayish.

He gives its distribution as "central Lower California, from San Ignacio to Comondú." But he remarks: "Birds from San Ignacio, which represents the northern limit of its range, are, as would be expected, most extreme in their characters. Two males and two females from Comondú, some distance south of San Ignacio, are intermediate between *Geothlypis beldingi goldmani* and *Geothlypis beldingi beldingi*, the females being more like the latter than are the males, which are but slightly different from *Geothlypis beldingi goldmani*. As a whole the Comondú birds are certainly referable to the northern race."

From the more northern portion of its breeding range, Griffing Bancroft (1930) reports that Goldmans yellowthroat is—

> resident in Santa Agueda, San Ignacio, and San Joaquim, the only localities where there is tule. These birds do not appear to care for willow associations. They are fairly common, especially in San Ignacio, where they nest in the heart of the heaviest tule patches. Their nests are strips of dead tule leaves, well woven and tied around several living stalks. The linings show individual variations but are usually of palm fibre. The nests are decidedly larger than those of more northerly birds. * * *
>
> The eggs of *goldmani* are a dull white, heavily spotted about the larger end, but otherwise almost immaculate. The decorative scheme is complicated. There are blotches, up to a millimeter in diameter, and a few hair lines which are jet black. A majority of the spots, many three millimeters long, are so weakly pigmented that they are gray and even have a suggestion of a lavender cast. Mixed throughout are specks of either color.

He gives the measurements of 13 eggs as averaging 18.7 by 14.5 millimeters. The measurements of 8 other eggs, apparently of this race, average 19.0 by 14.5 millimeters; the eggs showing the four extremes measure **19.7** by 14.5, 19.3 by **14.8,** and **17.8** by **14.0** millimeters (Harris).

CHAMAETHLYPIS POLIOCEPHALA POLIOCEPHALA (Baird)

RIO GRANDE GROUND-CHAT

HABITS

When Baird (1865) described and named the Rio Grande ground-chat he placed it in the genus *Geothlypis* and gave it full specific rank. Since then allied races have been named in Mexico and Central America. The subject of this sketch belongs to the northern race, found in northern and central Mexico, and is known to extend its range across our border only in the valley of the lower Rio Grande and the vicinity of Brownsville, Tex., where it seems to be rare.

This genus seems to be intermediate between *Geothlypis* and *Icteria*. Ridgway (1902) calls it "Ralph's ground-chat," and characterizes it as "similar in general appearance to *Geothlypis*, but tail longer than wing, graduated; bill very stout, with culmen strongly curved (much as in *Icteria*); tarsus nearly half as long as wing, or at least much nearer one-half than one-third as long; no black on forehead nor auriculars in adult males; sexes alike, or at least not very different in color." From *Icteria* it "differs in its shorter and more rounded wing, more graduated tail with pointed rectrices, longer tarsi, and stouter feet."

Nesting.—Very little seems to be known about the nesting habits of the Rio Grande ground-chat. A nest and four eggs are in the Thayer collection in Cambridge, collected by Gerald Thomas at Paisano, Tex., on May 1, 1902. The nest was in a clump of coarse grass near a road. The exterior was formed of dry grass and the interior with finer grass, with an inner lining of horsehair. Externally it measures 3¼ inches high by 3¾ in diameter; the inner cup is 2¼ inches deep and 1⅞ wide.

Eggs.—The four eggs are ovate and slightly glossy. They are creamy white, rather sparingly speckled, spotted and blotched with "auburn," "bay," "chestnut," and "raw umber," and with undermarkings of "pale brownish drab" and "light brownish drab." Some of them have small scrawls of very dark brown, almost black. The markings are somewhat concentrated at the large end, but none of the eggs could be termed heavily marked. The measurements of 16 eggs average 17.5 by 13.8 millimeters; the eggs showing the four extremes measure **18.5** by 13.7, 18.0 by **14.5, 16.9** by 13.2, and 17.8 by **12.7** millimeters (Harris).

Plumages.—The sexes are nearly alike in all plumages. The nestling plumage has apparently never been described. Ridgway (1902) describes the immature plumage as "similar in general to the adult plumage, but duller, the pileum concolor with back, or nearly so, and lores dull brownish gray or dusky, not distinctly different from color of pileum." The adults in fall and winter are "similar to the spring and summer plumage, but plumage softer, more blended; back, etc., more buffy olive or light olive-brown; feathers of pileum (at least the occiput) tipped with brown, and flanks more decidedly buffy."

Chapman (1907) says of the adult spring plumage: "Crown slaty with a slight olive wash, lores black, this color extending below the eye; a white mark on eye-ring above and below the eye; back, wings and tail olive-green without white markings, bend of wing yellow; throat and breast bright yellow becoming paler on the belly and brownish on the flanks."

In the adult female the black on the lores, so prominent in the male, is much restricted or nearly or quite lacking.

Dr. Wetmore (1943) writes of this species in southern Veracruz:

> This is a resident species, common in the Tres Zapotes region wherever bushes are scattered through the grasslands. They kept under cover ordinarily, flying out occasionally as I passed, or were seen as they sang from the tops of bushes or tall grass stems. The song is a low, rather inconsequential warble of several notes. I had a better view of them at times in crossing these savannas on mule back, as then from the elevation of the saddle I could see about more, and the birds were less wary. They tend always to be inconspicuous and to slip aside. They suggested the yellowthroats of the north in most of their habits. * * *
>
> On comparison of material in the U. S. National Museum it is evident that specimens from near Brownsville, Tex., in the lower Rio Grande Valley, differ from typical *poliocephala* in significantly paler color, with less yellow on the lower surface. They are to be separated therefore as *Chamaethlypis poliocephala ralphi* (Ridgway) in spite of the fact that Ridgway in his last account of the species placed the Texas birds under typical *poliocephala*. With a good series of skins the differences are clearly evident.

In his earlier description of *ralphi*, Ridgway (1894) calls it similar to "*G. poliocephala* Baird, but larger (the bill especially), upper parts grayer (the tail particularly), and the edge of the wing and under tail coverts much paler yellow."

DISTRIBUTION

Range.—Resident from southern Texas south through Mexico and central Mexico to Panamá. One race, the Rio Grande ground-chat (*C. p. poliocephala*), is found from southernmost Texas (Harlingen, Lomita, and Brownsville) south to Michoacán (Querendero) Morelos (Cuernavaca) and southern Tamaulipas (Aldama).

Egg dates.—Texas: 2 records, April 3 and May 1.

ICTERIA VIRENS VIRENS (Linnaeus)

EASTERN YELLOW-BREASTED CHAT

PLATES 71, 72

HABITS

This curious bird seems somewhat out of place among the wood warblers, on account of its large size, different proportions, and strikingly different behavior. There were confused ideas among the earlier writers as to where it belongs. Audubon classed it with the manakins, and others have placed it with the vireos or with the honeycreepers, but structurally it seems to be most closely related to the wood warblers, with its nine primaries, partly booted tarsus, and deeply cleft inner toe. It differs from the vireos, which also have nine primaries, in having no notch in the bill. But it also differs from the wood warblers in having a larger, heavier and more curved bill, shorter and more rounded wings, and relatively longer and more graduated tail.

During the breeding season the species *Icteria virens* occupies practically all the United States, except Florida, the Gulf coast, and northern New England. Its range extends into southern New England, where it is rare and irregular north and east of Connecticut, and into some southern portions of central Canada, where it is also irregular in its occurrence. Throughout all this range it is perhaps commoner than we suppose, on account of its secretive habits. Its favorite resorts are the very dense thickets and briery tangles that grow in profusion on low, damp ground, along small streams, or about the borders of ponds or swamps. But it also finds a congenial home in isolated patches of thick, tangled shrubbery on high, dry ground, in old, neglected pastures and along the edges of woodlands. Especially attractive are such upland thickets where small trees and bushes are entwined with an almost impenetrable tangle of catbrier, Virginia creeper, poison ivy, and wild grape vines. In such unattractive places for exploration, the bird is often overlooked by the casual observer, for it is a past master in the art of keeping out of sight. But a medley of strange sounds, musical and otherwise, catcalls, whistles, and various bird notes coming from points now here, now there in the bushes will betray the presence of this furtive and elusive clown among birds. Then, if we sit down quietly and squeak in imitation of a wounded bird, curiosity will prompt this versatile performer to show himself for a moment, after which he will disappear, to scold us from some remote corner of his retreat.

Courtship.—Chats are not much in evidence on their spring migration; they apparently do not often make long sustained flights in the open, but move along by short stages, keeping concealed for the most part in the dense thickets of shrubbery and vines, and are largely silent. But when they reach their chosen breeding grounds, the males proclaim their presence and advertise their home territory by the medley of whistling, chuckling, barking, and mewing sounds, coupled with the curious eccentricities that have made them famous.

When the females arrive, about a week later, the males greet them with a richer, more musical, and more pleasing performance, which P. A. Taverner (1906) describes very well, as follows:

> His love-song is a woodland idyl and makes up for much of his shortcomings. From some elevated perch from which he can survey the surrounding waste for a considerable distance, he flings himself into the air—straight up he goes on fluttering wings—legs dangling, head raised, his whole being tense and spasmodic with ecstasy. As he rises he pours fourth a flood of musical gurgles, and whistles that drop from him in silvery cascades to the ground, like sounds of fairy chimes. As he reaches the apex of his flight his wings redouble their beatings, working straight up and down, while the legs hanging limply down remind the observer of those drawings we sometimes see from the brushes of Japanese artists. He holds his hovering position for an instant, then the music gradually dies away; and, as he sinks toward the ground, he regains his natural poise, and seeks another perch like that from which he started. What mistress could turn a deaf ear to such love-making as that? And we can rest assured that his does not.

Nesting.—Although the eastern yellow-breasted chat has nested a number of times, rather irregularly, in Massachusetts, I have never found it farther north and east than Connecticut, where it is a regular and common breeder.

I find three typical nests recorded in my notes, found near New Haven, Conn., on June 3 and 4, 1910. The first was 3 feet from the ground in a clump of dogwood and hawthorn bushes; and the second was in a thicket of small black birches overgrown with catbriers, 30 inches above ground; both of these nests were rather insecurely attached to their supports; the locality was a large neglected tract of cut-over land, grown up to scattered clumps of bushes and sprouting stumps. The third nest was only 2 feet up in a small huckleberry bush in a scrubby field, full of underbrush and scattered red cedars. The three nests were all much alike, consisting of a foundation of dead leaves, coarse straws, and weed stems, on which was built a firmly woven inner nest of grapevine bark, thinly lined with fine weed stems and grasses.

A. Dawes Du Bois has sent me his notes on two nests found in Sangamon County, Ill., on May 30, 1908. The first of these was "two feet from the ground in a clump of blackberry briers, in a pasture thicket. It was constructed outwardly of small vine and weed stems, then a thick layer of dried oak leaves which formed the body of the nest. There was a slight lining of grasses and fine plant stems, inside the layer of leaves. A few shreds of coarse grass were added just before the layer of leaves was put in. There were 32 oak leaves and one elm leaf in the body of the nest, all smoothly laid in place. The dimensions were: Internal diameter 3 inches, depth 2; external diameter 5 inches, depth 3." The second nest was "3 feet from the ground in a wild gooseberry bush intergrown with blackberry briers, amid dense foilage, in a thicket-grown pasture." He mentions seven other nests, seen in Tompkins County, N. Y.; most were from 2½ to 5 feet up in various bushes, but one was "about 8 feet from the ground, loosely supported on a drooping young elm tree in a dense thicket."

T. E. McMullen's notes record data on 34 New Jersey and Pennsylvania nests found at heights from 18 inches to 5 feet; 21 of these were in blackberries, the others being in various bushes and vines; 3 were in hollies.

Nests of the yellow-breasted chat have doubtless been found in many other small trees and bushes, but the notes I have cited give a good idea of its usual nesting habits. Dr. Chapman (1907) says that he has known chats to nest in a village when favorable cover was available. A most unusual nesting site is recorded by Charles F. Batchelder (1881); a pair of chats began building a nest in a wren box on a piazza; a violent windstorm blew down the box, which was replaced, but the chats did not return.

Eggs.—The number of eggs laid by the yellow-breasted chat varies from 3 to 5 to a set, commonly 5, but as many as 6 have been recorded. The eggs are ovate and rather glossy. The white, or creamy white, ground color is speckled and spotted with "bay," "chestnut," "auburn," "argus brown," or "chestnut-brown," with underspottings of "brownish drab," "light vinaceous-drab," or "pale brownish drab." The markings, usually sharply defined, are generally scattered over the entire egg with some concentration at the large end. Often the brown and the drab markings are equally intermingled, and then again the drab spots may be entirely lacking. Some of the more attractive eggs are marked with blotches, often of two or three shades of brown mixed with the drabs. The measurements of 50 eggs average 21.9 by 16.9 millimeters; the eggs showing the four extremes measure 25.4 by 17.3, 22.1 by 18.3, 18.3 by 17.3, and 22.1 by 15.8 millimeters (Harris).

Young.—F. L. Burns (1915b and 1921) recorded the incubation period as 15 days, which is probably unusual, for George A. Petrides (1938) determined it to be 11 days "from the appearance of the full clutch." Burns gives 11 days for the young to remain in the nest, but Petrides says that they spent 8 days in the nest before leaving. The latter continues:

> The young were born naked. Brooding of both eggs and young was accomplished by the female alone during the period of observation, although both sexes evidently feed the young. * * *

The food of the young consisted almost entirely of soft-bodied orthoptera and larval lepidoptera. The only insect definitely identified was the large green mantis (*Paratenodera sinensis*), two half-grown specimens of which were fed the four-day old young. An unknown species of brown, almost hairless caterpillar was the greatest capture in numbers. A small green long-horned locust and a small brownish grasshopper also were fed the youngsters.

Four-day old young were fed only six times in five hours by the female, although the male attempted unsuccessfully to feed them several times. Copeland (1909), however, records a feeding time average of once every thirty-four minutes for the four-day old young over a thirteen-hour period.

The nest was kept very clean and the female, after feeding the young, would look carefully about the nest and if any excretory capsules were present she would pick them up in her bill and eat them. On one occasion, after swallowing the excretory sacs of two of the young she pulled a third capsule from the anus of the third and flew off with it.

Plumages.—The yellow-breasted chat seems to be the only wood warbler that develops no natal down, and the only one that has a complete postjuvenal molt, characteristics that suggest a wrong classification!

Dr. Dwight (1900) describes the juvenal plumage as "above, grayish olive-brown. Wings and tail olive-brown, edged with dull brownish olive-green. Below, ashy gray washed with olive-gray across the jugulum and on the sides. Auriculars grayish and lores dusky with a trace of white above the eye. * * * This plumage has been figured in colors (*Auk*, XVI, 1899, pp. 217–220, pl. III)."

The first winter plumage is "acquired by a complete postjuvenal moult after the middle of July. Two specimens examined show a complete moult in progress and the color and shape of rectrices in the limited material at my disposal points to this unusual moult, for this is the only Warbler known to me that renews wings and tail at this time."

He describes the first winter plumage of the male as "above, brownish olive-green, the wings and tail darker than in juvenal plumage and with greener edgings. Below, bright lemon-yellow, somewhat veiled with olive-gray, the abdomen and crissum dull white, the sides washed with olive-brown. Lores, suborbital region and postocular stripe dull black, veiled with ashy feather tips. Superciliary, suborbital and malar stripes white. Young and old become practically indistinguishable although young birds are rather duller."

The first and subsequent nuptial plumages are assumed by wear and slight fading of the browns and greens. Adults have a complete postnuptial molt in July, producing the adult winter plumage, which differs but little from that of the first winter, the black areas about the head averaging blacker.

Females have the same molts and similar plumages, the colors being only lighter or duller.

Food.—Probably all of the items mentioned above in the food of the young are also eaten by adult chats. A. H. Howell (1932) writes: "The Chat feeds largely on insects, including beetles, bugs, ants, weevils, bees, wasps, May flies, and various caterpillars, such as tent caterpillars and currant worms. It is said to be fond of wild strawberries and takes considerable other wild fruit, such as blackberries, raspberries, whortleberries, elderberries, and wild grapes. The stomachs of 7 specimens taken on Amelia Island in May and June contained insects and fruit pulp in about equal proportions, with a few spiders and small crustaceans. The insects included moths and their larvae, beetles, bugs, ants, wasps, and grasshoppers. The fruit consisted of blueberries and blackberries." Elsewhere (1907) he lists the chat among the birds that eat the cotton-boll weevil.

Behavior.—Next to its astonishing vocal performances, the eccentric, ludicrous, almost clownish, behavior is one of the chat's most outstanding characteristics. Although a bit fanciful and imaginary, Dr. J. M. Wheaton's (1882) account is a good character study of this buffoon of the brier patch.

> If he discovers the approach of a human being, even at a considerable distance, he prepares to resent the intrusion; and giving three short, loud whistles, very low in tone, as a warning, he advances toward him, all the while careful that he should be heard and not seen. Then follows a medley of sputtering, cackling, whispering and scolding notes, frequently interspersed with loud whistles, and continued as the bird runs, hops, or flies in the densest thicket, with a pertinacity that knows no fatigue. He tells you that your gun won't shoot, that it is a flint-lock, that your ramrod is broken, that you shot it at a buzzard, that you haven't got a gun; that you are a bald-headed cripple; that there is a horrid suicide in the bushes, and a big snake and a nasty skunk; that your baby is crying, your house is afire and the bridge broken down; that you have missed the road to the reform farm, and that the poor house is over the creek, and he calls the dogs; says that you have gone to seed; go west and grow up with the country; that you are taking up too much of his valuable time, and that you must excuse him for a moment.
>
> During all this time he remains invisible, or at most, his black eye and mask, or golden breast, appear for a moment as he peers at you from the tangled branches of the brambles, or flashes from branch to branch, dancing an accompaniment to his fantastic notes. And at last, he suddenly appears on the top of a bush not ten feet from you, makes a profound bow, and with a derisive whisk of his long tail, exposes his immaculate white crissum and dives again into the deepest thicket. You take a long breath and wipe your face, and he returns to the assault from the rear. Should you move on, he follows, and if you approach, he retires, and, keeping at a respectful distance, he laughs defiance, shouts mockery and tantalizing sarcasm. He is a fearful scold, and it is no wonder the inside of his mouth is black.

And Taverner (1906) gives the following character sketch:

> With his stealthy elusiveness, wild outpourings of song and fund of vituperation, the Chat is a droll imp. * * * He is full of life and boiling over with animation. It bubbles out of his throat in all manner of indescribable sounds.

> He laughs dryly, gurgles derisively, whistles triumphantly, chatters provokingly, and chuckles complacently, all in one breath. He throws himself about through the bush regardless of consequences, never still, scrutinizing the intruder in all attitudes. Viewing him now from under a branch, and then from over it, talking always exictedly, rather incoherently and usually indelicately. In fact, one throat is not sufficient to relieve the pressure of his feelings, and he presses into service his long tail, and with it wig-wags things such as even he, irresponsible little sprite that he is, dare not say out loud.

The chat has a well-deserved reputation for shyness and elusiveness. When the nest is approached, the incubating female will usually slip off it and away without being observed; and she has been said to desert her eggs, or even her young, on slight provocation. But this is not always the case, as is shown by the many excellent photographs that have been taken of the bird at its nest. A. D. Du Bois tells me that on three out of nine of the nests examined by him, the sitting bird was quite tame, allowing him to approach quite closely and, in one case, almost to touch her. Gradual and careful approach to the nest gave Petrides (1938) an opportunity to take some fine pictures and to study the home life of the chat. "The blind, a green umbrella tent six and one-half feet high, was first erected some eighteen feet from the nest and moved forward about four feet every other day until, when the eggs were hatched, the tent was only two and one-half feet from the nest. On each visit several leaves were plucked from before the nest until it was well exposed."

His second nest "was approached noisily through the underbrush on six different occasions and the contents lifted out and handled," but the birds did not desert it.

Voice.—To the comments already made on the chat's vocal performances must be added the more serious contribution of Aretas A. Saunders, who says: "The song of the yellow-breasted chat is not only entirely unlike that of any other warbler, but unlike that of any other bird with which I am acquainted. It is long-continued, and consists of a variety of notes and phrases delivered in an irregular, mixed order, with pauses between them. The phrases vary greatly in quality, consisting of whistles, harsh cackles, squawks, squeals, and various explosive noises, not always easy to describe. Some of these are single short notes, short series of notes, or long series, often retarded in time.

"The pitches of these various sounds range from B′ to A‴, almost two octaves. Songs of individual birds range from three and a half tones to seven and a half, averaging about an octave. The songs are sometimes fairly rapid, and at other times slow. I have one song recorded as 7 phrases in 9 seconds, and another where the average pause between phrases was 6 seconds.

"I have records from 20 different birds, but only those of 11 are believed to be complete, that is, all the phrases commonly used are recorded. These 11 birds each had from 6 to 10 phrases in their song, averaging about 7. Only one bird had 10 phrases; of these 5 were single notes, 3 being whistles, 1 harsh, and 1 like a note on an organ; 2 other phrases were of several notes repeated in even time, one whistled, the other very harsh; the other 3 were long series of notes, retarded at the end, two of them whistled but on different pitches, the other like a long rattle. I recorded the singing of this bird, and the order of phrases, as it sang 48 phrases. There was great variety in the arrangement. One phrase was used 11 times, another 10, while 2 other phrases were sung only once, and the others from 2 to 8 times each.

"Not only is the song unusual, but also the manner of singing, for the bird frequently flies from one bush to another while singing, flapping its wings up and down and pumping its tail, with its legs dangling, the line of flight being exceedingly jerky.

"This bird is reported to imitate other birds. I have never heard any thing I believed was an actual imitation, but there are often sounds that suggest the sounds of other birds. I recorded one such as 'like the *chuck* of a robin,' and another as 'like a note of the yellow-throated vireo,' but I did not consider them to be imitations.

"The chat sings from the time of its arrival in spring until about the third week in July, but I have too few observations to give average dates of cessation."

The yellow-breasted chat, according to Albert R. Brand (1938), has the lowest-pitched voice of any of the warbler family, its highest note being but little above the average frequency of all passerine song; he recorded the highest note as having a frequency of 4,400 vibrations per second, the lowest 1,275 (the lowest of all but the starling and the catbird), and the approximate mean 2,600 vibrations per second (lower than all but three or four others).

Several observers have classed the chat as a mimic, and it certainly gives that impression, but its own vocabulary is so extensive and varied that perhaps it is only an impression; it does not need to learn much from others.

It is a most versatile vocalist and a most persistent singer at times; its voice may be heard at any hour of the day or night, especially on moonlit nights. To try to express its varied notes in syllables is almost hopeless. Mr. Forbush (1929) suggests the following: "*C-r-r-r-r-r*, *whrr*, *that's it*, *chee*, *quack*, *cluck*, *yit-yit-yit*, *now hit it*, *tr-r-r-r*, *when*, *caw*,*caw*, *cut*,*cut*, *tea-boy*, *who*, *who*, *mew*, *mew*, and so on till you are tired of listening." Dr. Witmer Stone (1937) heard one give a rapid call like that of a kingfisher. "One singing from inside a wild cherry bush had a trill like that of a tree toad, a *pheu*, *pheu*, call like a Greater Yellow-legs, and a strange note resembling a dis tant automobile horn. One of the other birds sat on the top of a dead bush in full view, all hunched up as if its back were broken and with tail hanging straight down. Every now and then it would stretch up its neck, which appeared very thick and out of proportion, with feathers all ruffled up on end, and utter a triple note *hoo-hoo-hoo*."

The chat usually sings within the dense thickets in which it hides, or perhaps from the top of some small tree or bush only a few feet above the thicket, but Clarence F. Stone mentions in his notes, sent to me by Verdi Burtch, one that he heard and saw singing in the top of a large tree, 45 feet above the ground.

Dr. Daniel S. Gage tells me that he heard a chat give a number of times "a note which we could liken only to the sweet tone of a silver bell."

Field marks.—Its large size, heavy bill, and long tail will distinguish the eastern yellow-breasted chat from any of the other wood warblers, also from the yellow-throated vireo, which it suggests in color pattern, though the chat has no white wing bars. The olive-green upper parts, with no white in wings or tail, the white stripe over the eye, the bright yellow throat and breast, and the pure white abdomen are all diagnostic. Its behavior and, above all, its vocal performances are unlike those of any other bird; as it is more often heard than seen, it is most easily recognized by its noisy voice.

Enemies.—The yellow-breasted chat is a common victim of the cowbird, but it will often desert its nest after the alien egg is deposited. Dr. Friedmann (1929) gives about one hundred records of such parasitism, and mentions only three cases of tolerance, though doubtless there have been many other cases where chats have accepted the eggs, which are about the same size as its own, and have raised the young. He says: "Apparently there is considerable variation in the sensitiveness of Chats around their nests, but the bulk of the evidence goes to show that normally a Cowbird's egg has little chance of ever being hatched by a Yellow-breasted Chat."

Winter.—Dr. Skutch contributes the following account: "During the winter, the yellow-breasted chat spreads over Central America, including both coasts and the lower parts of the highlands, as far as southern Costa Rica. In this country it is rare and I have never seen it; but I knew it as a rather abundant winter resident in the Caribbean lowlands of Honduras, and on both sides of Guatemala. Here I found it on the coffee plantations of the Pacific slope, up to about 3,500 feet above sea-level, in January; and while I have no midwinter record for higher altitudes, on the shore of Lake Atitlán, at 4,900 feet, during the last week of October, I saw two—a number which, considering the retiring habits of the bird, indicates fair abundance.

"The chats arrive in northern Central America toward the end of September. On October 1, 1930, they suddenly became exceedingly numerous in the narrow valley of the Tela River in northern Honduras. As I passed from a dense second-growth thicket to the comparatively open vegetation of the flood-plain of the river, I was greeted by a chorus of chucks and cackles, which reminded me strongly of the sound of a distant flock of purple grackles or red-winged blackbirds; the voices were by no means so loud as those of the blackbirds when chattering close at hand, yet in aggregate they created much the same impression. A numerous party of garrulous yellow-breasted chats had spread out among the trees and vine-tangles of the stony plain. Although they so loquaciously proclaimed their presence, the birds were yet so wary, lurking among the densest tangles, that they were by no means easy to glimpse; but during the course of an hour I saw a number, and watched them forage among the Cecropia and other trees. Among their varied utterances were harsh *clucks*, as a man makes by clacking his tongue far back in his mouth, to urge a laggard horse, and nasal notes like those of the catbird. How unexpected to come upon a warbler with a voice like a grackle! Soon the chats were well distributed over the valley; and their calls sounded from every side all through the day.

"While migrating, yellow-breasted chats may at times appear in the most surprising situations. On October 5, 1934, I found one among the open shrubbery of the central plaza of the town of Retalhuleu, on the Pacific coast of Guatemala. Without much doubt, this bird used the little park only as a temporary place of rest, and soon moved on to a more sequestered spot.

"When well settled in their winter home, the chats gradually grow less loquacious. The flocks in which they apparently arrive soon disperse; and they live in solitude through the winter months. Avoiding the forest, they hunt through the most tangled thickets, where their presence would scarcely be suspected but for their harsh notes occasionally voiced. They are at all times so secretive that to glimpse one is a feat—or an accident. They linger deep in their vine-smothered thickets until about the middle of April, then return northward.

"Early dates of fall arrival in Central America are: Guatemala—passim (Griscom), September 24; Colomba, September 29, 1934. Honduras—Tela, October 1, 1930.

"Late dates of spring departure from Central America are: Costa Rica—El Pozo de Térraba (Underwood), April 9, 1906. Guatemala—passim (Griscom), April 7; Motagua Valley, near Los Amates, April 17, 1932."

DISTRIBUTION

Range.—Southern Canada, the United States, Mexico, and Central America.

Breeding range.—The yellow-breasted chat breeds **north** to southern British Columbia (Sumas, probably Penticton, Vancouver, and Kamloops); central southern Alberta (Milk River Valley); southern Saskatchewan (Cypress Lake and East End, probably Tregarva); northwest and central northern North Dakota (Minot, Charlson, and Rice Lake); southern Minnesota (Hendricks and Wilder); southern Ontario (Harrow, Port Burwell, probably Coldstream, Hamilton, and Oshawa); central New York (Rochester, Geneva, Holland Patent, and Schenectady; probably Granville); southern Vermont (Bennington); and southern New Hampshire (South Hooksett). **East** to southern New Hampshire (South Hooksett) and south along the Atlantic coast to northern Florida (Tallahassee); rare breeder on Coastal Plains. **South** to northern Florida (Tallahassee, Amelia Island, and Pensacola); Texas (Fort Worth, Houston, Kerrville, Hidalgo, and Brazos County); southern Tamaulipas (probably Tampico); Mexico (Mexico City); Jalisco (Ocotlán and Lagos); southern Sonora (Lower Río Yaqui and Quiriego); and south-central Baja California (Comondú). **West** to Baja California (Comondú) and the Pacific coast (except Oregon and Washington west of the coastal ranges) to southern British Columbia (Vancouver).

Winter range.—The yellow-breasted chat winters **north** to southern Baja California (Cabo San Lucas); southern Sinaloa (Esquinapa); and southern Texas (Laredo). **East** to southern Texas (Laredo); central Tamaulipas (Arroyo de la Presa); Veracruz (Motzorongo and Tres Zapotes); Tabasco (Frontera); Yucatán (Mérida, and Chichén-Itzá); Quintana Roo (Xcopén, Chunyaxché, and Cozumel Island); Honduras (Ceiba and Yaruca); Nicaragua (Greytown); Costa Rica (San José); and western Panamá (Almirante). **South** to western Panamá (Almirante); El Salvador (Puerto el Triunfo and Lake Olomega); Guatemala (Volcán de Fuego, Cobán, and Choctum); Oaxaca (Llano Grande and Tehuantepec City); and Colima (Colima and Manzanillo). **West** to Colima (Manzanillo); southern Sinaloa (Esquinapa); and southern Baja California (Cabo San Lucas).

Chats have been recorded casually north to southern Manitoba (Brandon); northeastern North Dakota (Fort Union); central Minnesota (Brainerd and Saint Cloud); southwestern Maine (North Bridgton, Eliot, and Portland); and south on peninsular Florida (Dunedin, Fort Myers, and Key Largo). They are accidental in New Brunswick (Saint Andrews and Grand Manan); rare in southwestern British Columbia (Comox and Courtenay); and north to southwestern California (San Diego).

The range as above outlined is for the entire species, which has been separated into two geographic races. The eastern yellow-breasted chat (*Icteria virens virens*) breeds west to South Dakota, Nebraska, Kansas, and eastern Texas, wintering from eastern Mexico south through Central America to western Panamá; the western yellow-breasted chat (*Icteria virens auricollis*) occupies the western part of the range to the Pacific coast, wintering in western Mexico and Central Guatemela.

Migration.—Late dates of spring departure are: Costa Rica—Pozo del Rio Grande, April 9. El Salvador—Lake Olomega, April 12. British Honduras—Mountain Cow, April 7. Guatemala—near Quirigua, April 17. Texas—Cove, May 12; Dallas, May 13.

Early dates of spring arrival are: Florida—Titusville, April 19; Pensacola, April 17. Alabama—Greensboro, April 8; Birmingham, April 14 (average of 10 years, April 19). Georgia—Round Oak, April 9. South Carolina—Summerville, April 9. North Carolina—Charlotte, April 14; Raleigh, April 17 (average of 29 years, April 25). Virginia—Cape Henry, April 16; Rockbridge County, April 22. West Virginia—Wheeling area, April 23; French Creek, April 26 (average of 17 years, April 30). District of Columbia—Washington, April 16 (average of 52 years, April 30). Maryland—Chevy Chase, April 14. Delaware—Kent and Sussex Counties, March 29 (average of 18 years, April 10). Pennsylvania—Mercer County, April 21; Renovo, April 24 (average of 25 years, May 7). New Jersey—Montclair and Livingston, April 30. New York—Bronx, April 28; Ithaca, May 4 (average, May 12). Connecticut—New Haven, May 1. Rhode Island—Providence, May 2. Massachusetts—Amherst, April 22 (1929); East Longmeadow, May 7. Vermont—Bennington, May 11. New Hampshire—East Westmoreland, May 8. Maine—Kittery and Falmouth, May 16. Louisiana—Bains, April 4. Mississippi—Bay St. Louis and Oxford, April 11. Arkansas—Helena, April 7 (average, April 20). Tennessee—Nashville, April 16 (average of 12 years, April 21). Kentucky—Eubank, April 19. Missouri—Kansas City, April 14. Illinois—Murphysboro, April 19; Chicago region, May 6 (average, May 16). Indiana—Wheatland and Columbus, April 22. Ohio—Hamilton County, April 18; Barnesville, April 24 (1929) (average for central Ohio, May 2). Michigan—Kalamazoo, May 2. Ontario—Oshawa, May 5. Iowa—Fairfield and Waubonsie State Park, May 9. Wisconsin—Mazomanie, May 4. Minnesota—Red Wing, May 14. Texas—Victoria, March 15. Oklahoma—Oklahoma City, April 5; Tulsa, April 12. Kansas—Manhattan, April 22. Nebraska—Nebraska City, and Dunbar, April 29. South Dakota—Yankton, May 5. North Dakota—Wilton, May 15. Manitoba—Brandon, May 25. Saskatchewan—Skull Creek, May 11. New Mexico—Socorro, May 1. Arizona—Topock, April 11. Colorado—Lytle, May 6. Utah—Washington County, April 27; Salt

Lake, May 8. Wyoming—Guernsey and Torrington, May 10. Idaho—Meridian, May 13. Montana—Kirby, May 16. California—Los Angeles County, April 1; San Francisco Bay region, April 14. Nevada—Vegas Wash, May 3. Oregon—Oswego, Portland, and Eugene area, April 28. Washington—Yakima and Walla Walla, May 4. British Columbia—South Vancouver, May 9.

Late dates of fall departure are: Washington—Touchet, September 12. Oregon—Weston, October 2. Nevada—Indian Springs, Charleston Mountains, September 15. California—Azusa, October 9. Idaho—Moscow, September 10. Wyoming—Careyhurst, September 11. Utah—Uinta Basin, September 25. Colorado—Yuma, September 24. Arizona—Keams Canyon, October 12; San Pedro River, October 15. New Mexico—Apache, September 15. Saskatchewan—East End, August 14. North Dakota—Stutsman County (September 22; Fargo, October 11. South Dakota—Faulkton, October 20. Nebraska—Lincoln, September 26. Kansas—Lawrence, October 23. Oklahoma—Oklahoma City, September 17. Texas—Cove, November 10. Wisconsin—Mazomanie, September 3. Iowa—Sioux City, October 2. Michigan—Locke, October 2. Ohio—Hillsboro, October 16; central Ohio, September 22, (average, August 27). Indiana—Bloomington, September 28. Illinois—Murphysboro, September 12. Missouri—Creve Coeur Lake, September 25. Kentucky—Fulton County and Bowling Green, September 23. Tennessee—Elibabethton, October 8. Arkansas—Saline County, September 19. Mississippi—Deer Island, October 19 and 29. Louisiana—Baton Rouge region, October 22, December 28. New Brunswick—Grand Manan, December 1; St. Andrews, December 11. Maine—Seguin Light, October 5; Kittery, December 10. New Hampshire—Boar's Head, September 19. Massachusetts—Essex County, October 27 (more than 20 November and December records in the past 5 years). Rhode Island—Little Compton, November 12. Connecticut—New Haven County, October 3, November 23; South Norwalk, January 1. New York—Mastic, Long Island, October 31; Jones Beach, Long Island, November 13. New Jersey—Cape May Light, September 29; Long Branch, December 15. Pennsylvania—Renovo, October 2; Norristown, November 28. Delaware—Kent and Sussex Counties, September 30 (average of 18 years, August 30). Maryland—Ocean City, October 5; Patuxent Wildlife Research Refuge, November 1. District of Columbia—Washington, October 4 (average of 8 years, September 19). West Virginia—Bluefield, October 6. Virginia—Rockbridge County, October 2; Cape Henry, October 22. North Carolina—Weaverville, October 1; Raleigh, September 19 (average of 8 years, August 8). Georgia—Athens, October 18. Alabama—Birmingham, October 30 (average of 10 years, September 24). Florida—Pensacola, October 12.

Early dates of fall arrival are: California—Azusa, August 31. Mississippi—near Biloxi, August 27. Rhode Island—Block Island, August22. Guatemala—Colomba, Quezaltenango, September 29. Honduras—near Tela, October 7. Nicaragua—Escondido River, October 14. El Salvador—Divisadero, October 10. Costa Rica—San José, October 26.

Egg dates.—Arizona: 29 records, April 26 to Aug. 1; 16 records, May 21 to June 9; 7 records, July 15 to 25.

California: 62 records, May 4 to July 13; 32 records, May 13 to June 4, indicating the height of the season.

Georgia: 18 records, May 9 to June 2; 10 records, May 13 to 20.

Pennsylvania: 31 records, May 19 to June 25; 18 records, May 30 to June 12.

Texas: 39 records, April 10 to June 25; 20 records, May 6 to 26 (Harris).

ICTERIA VIRENS AURICOLLIS Lichtenstein

WESTERN YELLOW-BREASTED CHAT

HABITS

The western race of the yellow-breasted chat is only slightly differentiated from its well-known eastern relative. Ridgway (1902) describes it as "similar to *I. v. virens*, but wing, tail, and bill longer, the tail always, or nearly always, longer than wing, instead of the reverse; upper parts more grayish olive-green, usually more nearly gray than olive-green; white of malar region much more extended, frequently occupying entire malar area; yellow of under parts averaging deeper."

It is well distributed, generally common, and locally abundant over much of North America during the breeding season from the Pacific coast to the Plains, and from British Columbia and extreme southern Saskatchewan to the Mexican plateau. Only within comparatively recent years has the chat been known to breed across the southern boundary in Saskatchewan, south of the Cypress Hills. Although Dr. Bishop, Dr. Dwight, and I did considerable field work in this region and in southern Alberta in 1906, we failed to find it. Some years later, Laurence B. Potter wrote to me: "Since the first discovery of the yellow-breasted chat by Taverner, in 1921, in southwestern Saskatchewan, the species has established itself as a regular, and not uncommon, summer visitant. For twenty years previous to Taverner's taking the first specimen, I had lived in the same district, watching and hearing birds; but it was not until 1922, a year later, that I first heard a chat, the male bird of a pair that certainly were nesting. And I feel quite sure the species was, at that time, a newcomer." Some thirteen years later, Mr. Potter (1935) established the chat as a breeding bird in that vicinity by finding a nest with eggs.

The western yellow-breasted chat, as it is now called, has evidently permanently extended its breeding range slightly north of the international boundary in southwestern Saskatchewan. J. Dewey Soper (1942) writes:

> From June 15 to 18, 1941, I camped at the Frenchman River about 200 yards from the International Boundary. The valley here is several miles wide and between 300 and 400 feet deep, the bottom of which is approximately 2,500 feet a. s. l. It exhibits pronounced arid characteristics such as sparse, short-grass cover, an abundance of cacti, broad sagebrush and greasewood flats, rattlesnakes, horned lizards, etc. A few miles up the valley are several towns of the Black-tailed Prairie Dog. The river is bordered by rather extensive and very dense thickets of willows, buckthorn, green ash, wild rose, snowberry, gooseberry and sagebrush. Zonal conditions lean conspicuously to the Upper Sonoran.
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> No sooner was the locality entered than Long-tailed Chats were heard on every hand. This was at once recognized as an unusual experience. As the bottomland thickets were carefully explored in the days that followed, it was increasingly realized that *longicauda* was not only common, but actually abundant. * * * I hesitate to express an opinion as to the number of chats in the neighborhood, but they may have totaled between fifty and one hundred. If the former figure should approximately apply (which strikes me as very conservative), then the average would have been about one pair to every 140 yards.

In the Great Basin region, in Nevada, according to Dr. Jean M. Linsdale (1938), "The large, dense thickets of buffalo berry, intertwined with willow and rose provided satisfactory home sites for this bird; in Smoky Valley in favorable stretches of a mile 3 or 4 pairs could be detected. Year after year noises made by this bird came from exactly the same spots. Either these were more suitable than other spots which appeared to be similar, or the birds exhibited an especially strong tendency to return to the same bushes."

In the Lassen Peak region of California, Grinnell, Dixon, and Linsdale (1930) say that "chats were limited closely to the tangles of tall weeds, brush (willow, rose, blackberry, elder) and grapevines that bordered the lower stream-courses."

Nesting.—The western chat does not seem to differ materially from its eastern relative in its nesting habits, or in any of its other habits.

The nests are usually not over 2 or 3 feet from the ground in thickets of willows, wild rose bushes, or other shrubs, often overgrown with grapevines or other tangles. Grinnell, Dixon, and Linsdale (1930) record one that "was slightly over two meters above the ground in a vine that covered a dead tree. A large cottonwood close by furnished shade. The site was about on a level with the top of the undergrowth of willows, weeds, and elders."

Eggs.—The eggs are indistinguishable from those of the eastern chat. The measurements of 50 eggs average 21.8 by 16.6 millimeters;

the eggs showing the four extremes measure 25.4 by 17.8, 20.3 by 19.1, 18.3 by 15.2, and 19.3 by 14.7 millimeters (Harris).

Young.—Mrs. Wheelock's observations (1904) indicate rather rapid feeding by both parents at a nest that she watched:

> On one day, which seemed to be a fair average, when the young were eight days old, they were fed twenty times between five and six a.m., eight times between nine and ten a.m., eleven times between three and four p.m., and seventeen times between five and six p.m. For the first four days there was no visible food in the bill of the adult, and the feeding seemed to be by regurgitation. After that, parts of insects could be seen protruding from his bill, and were given to the young in a fresh state. Beetles, grasshoppers, and butterflies were all in the dietary, and were brought indiscriminately; but hairless caterpillars seemed to be the favorite food. The adults are said to eat berries, but I saw none brought to the nest for the young.

Behavior.—Chat behavior is much the same in the west as in the east, but the following observations on the territorial behavior and daily routine of the long-tailed western chat, by Eric Campbell Kinsey (1934), are of interest:

> The usual territorial rights, enforced by breeding birds generally, so far as their own species is concerned, obtained markedly with the chats. Each breeding pair appeared to stay strictly within its own territory except when there was a general alarm emanating from a particular territory (such as that occasioned by pilfering jays or hawks), when a number of chats would congregate at that spot to aid in driving away the would-be despoilers.
>
> Each chat followed a very definite schedule each day. For example, a certain male would appear at dawn on a particular dead branch some fifty feet up in a cottonwood tree and, after a short song, would then fly down to a definite spot in an adjacent flooded meadow, whereupon satisfying his appetite he would return to the original perch. After remaining there for several minutes, singing, he would repair to a particular branch in the middle of a nearby elderberry bush, drop from there to a certain nettle stalk, cross to the nest where his mate was brooding eggs, and after (presumably) feeding her would again return to the dead branch in the cottonwood. Then he would fly to the irrigation ditch for his early morning plunge, return again to the cottonwood branch, preen and complete his toilet; then down into the meadow for more insects, back to the original cottonwood, again to the elderberry patch, down to the nest, etc. This routine was followed out with little variation throughout the morning. Immediately after mid-day he would descend from the cottonwood to another patch of elderberries on the opposite side and to an adjacent dry meadow where grasshoppers were quite plentiful; then would again return to the cottonwood, from there drop down to the nest, and, after being satisfied that all was as it should be, would once again return to the cottonwood. The same procedure would be followed all during the afternoon, broken only by a bath in the irrigation ditch just before dusk. The nest was situated due east of the cottonwood and it was the eastern part of the territory, upon which the sun shone, that he foraged in the morning. In the afternoon the sun was on the west of the cottonwood and it was the western section of the territory that then received his attention.
>
> This species is apparently as casual as are hummingbirds, so far as their mates are concerned. Again, to illustrate, a certain female was trapped late

one afternoon whereupon her mate appeared next forenoon with a new female and, on the succeeding day, this pair started constructing a new nest near the site of the old one. On the following day the male was trapped and on the next day what we assumed was the remaining female appeared with a new male and afforded every evidence of mating. This particular pair was located at one of the extreme ends of the territory covered. Another pair was under observation at the other end of the territory, where the male was first trapped; two days later the female appeared with a new mate whereupon she was trapped and, on the following day, the same male appeared with a new female.

Voice.—Many writers have referred to chats as mimics; whether the various notes heard from chats are really imitations or are parts of the birds' own elaborate vocabularies is open to question. However that may be, we have the following list of possible imitations heard by Grinnell, Dixon, and Linsdale (1930):

> Facsimiles that were heard and checked within a few days in late May and early June were as follows: gray squirrel (the "coughing" note); young turkey (of which many were herded around the ranch at Dale's to feed on grasshoppers); willow woodpecker (the high-pitched "whinnying"); Bullock oriole (the harsh call-note only); crow (the caw, repeated four to six times, or, sometimes, just once, accurately given); ash-throated flycatcher (call-note); wren-tit (without the terminal trill, but accurate in pitch and timbre—no wren-tits were seen within six miles of this place [Dale's]); Pacific nighthawk (*pe-ärk*, perfectly rendered); California jay (one of the staccato calls); Steller jay (a staccato note); flicker (the *kuk-kuk-kuk* note); yellow-billed magpie (perfect, though magpies were not found by us in the near neighborhood); meadow-lark (a call-note); slender-billed nuthatch (*yank*, loud nasal note); robin (*cluck-cluck*, note of mild alarm).

EUTHLYPIS LACRIMOSA TEPHRA (Bonaparte)

WESTERN FAN-TAILED WARBLER

HABITS

The casual occurrence of this species at Santo Domingo, northern Baja California, where, according to Grinnell and Lamb (1927) a single specimen was taken by Lamb on December 31, 1925, entitles this primarily Mexican species to a place on our list. The bird "was on the ground in a damp spot beneath a pepper tree on the Hamilton ranch. Had been seen several times previously the same day, flying nervously from object to object on the ground, at times flirting its tail sidewise and uttering a single lisping whistle."

The following description of the juvenal plumage, which Ridgway (1902) did not describe, is given by Dickey and van Rossem (1938):

"Upperparts, including sides of head and wing coverts, uniform 'dark neutral gray'; chin, throat, and chest, 'hair brown' or 'fuscous'; flanks similar but more sooty; median underparts, including under tail coverts, pale 'primrose yellow,' mingling with the color of the chest in the form of broad streaking or mottling; wings and tail essentially as in adult, but rectrices more pointed.

"The postjuvenal body plumage is apparently identical with that of the adult. The juvenal remiges and rectrices are retained through the following breeding season. There is no evidence of more than one molt a year."

In El Salvador, they found the fan-tailed warbler a—

> fairly common resident of the foothills and mountains in the Arid Lower Tropical Zone. Although found from elevations varying from 200 to 3,500 feet, the species is relatively rare below 500 feet.
>
> "Rock warbler" would be a name fully as appropriate as fan-tailed warbler, for throughout its El Salvador range this species is an inhabitant of rocky ravines and jungle-covered lava flows. In addition there appear to be other requirements such as thin undergrowth beneath tall forest so that, although the species has a wide range, the distribution is necessarily spotty in character.
>
> The general appearance of this warbler is very similar to that of a redstart—a resemblance due in no small measure to the continual nervous fanning of the tail. Living as these birds do in heavily shaded situations among dark rocks, they would be nearly invisible were it not for this curious habit. In life the brightly colored underparts are not often noticeable, and the tail movement, in which the white terminal spots are alternately flashed out and concealed, is the most betraying character. When this bird works over rocks and through leaf litter, it has, except for the tail movements, no jerky motions. The birds steal about quickly, taking full advantage of all cover. They do not hop like thrushes and most sparrows, but walk after the manner of larks and the North American oven-birds.
>
> Rocks being their preference these warblers are never found on the flat portions of the coastal plain, although they descend to very low levels where there are old lava flows. The deep, gloomy ravines so numerous on the Colinas de Jucuarán and Volcán de Conchagua, provide an ideal environment, and fan-tailed warblers are perhaps more common in these two localities than in any others.

Ten stomachs examined contained insects exclusively.

DISTRIBUTION

The fan-tailed warbler is a resident species ranging south from southern Sonora (Guirocoba); southern Chihuahua (Hacienda de San Rafael); and southern Tamaulipas; south through the Isthmus of Tehuantepec to southwestern Guatemala and Nicaragua. It is accidental in northern Baja California (Santo Domingo).

CARDELLINA RUBRIFRONS (Giraud)

RED-FACED WARBLER

PLATE 72

HABITS

This well-marked and striking species is a Mexican bird that has extended its range into southern Arizona and southwestern New Mexico. Since the bird is common in the mountains of Mexico, it is not surprising that it should follow the trends of these ranges into the United States, as some other species have done. Early reports of the occurrence of the red-faced warbler in Texas having been discredited as probably erroneous, it was definitely added to our fauna by Henry W. Henshaw (1875), who "met with the species at two points, near Camp Apache, and again on Mount Graham, a point some two hundred miles to the south. At the former place, several specimens were captured, including the young in nesting plumage, thus indicating that they breed in the vicinity."

The northern red-faced warbler is essentially a bird of the mountain canyons, breeding quite commonly from 7,000 feet upward in probably all of the mountain ranges of southeastern Arizona and southwestern New Mexico. Dr. Edgar A. Mearns (1890) found it to be "a summer resident from near the lower border of the pine belt to the summit of the Mogollon Mountains. It was not seen in the San Francisco Mountains, but was found breeding about thirty miles south of them," in Arizona. We found it common in Ramsay Canyon in the Huachuca Mountains, mainly between 6,000 and 8,000 feet, where the sloping sides of the canyon were clothed with spruces, firs, and, higher up, with pines. Here the bright red faces of the otherwise sombre-colored males flashed like glowing embers in the dark shadows of the conifers and quickly caught the eye.

Dr. George M. Sutton (1943) found it common in the Santa Rita Mountains, south of Tucson, where "every open aspen copse visited by the writer sheltered a pair of these handsome birds." Mrs. Bailey (1928) mentions a number of localities in New Mexico where it has been observed or found breeding.

Spring.—The red-faced warbler may eventually be found breeding farther north than is now known, as it seems to be more abundant in southern Arizona on the spring migration than during the breeding season, suggesting that some may be passing through that region. O. W. Howard (1899) says: "These birds are quite common in the mountains of Southern Arizona, especially during the spring migration. I have seen as many as four or five feeding in one tree. They become scarcer as the season advances and at the time of breeding comparatively few of them remain." And Harry S. Swarth (1904) says that, in the Huachucas, it is "found during the breeding season from 7000 feet upwards, and in the migrations as abundant in the higher pine regions as anywhere. The first arrival was noted April 20th, and up to the middle of May they were seen in considerable numbers along the canyons, often in company with other migrating warblers. During the breeding season their numbers seem to be greatly decreased, but this is probably more apparent than real, as at this time they are very quiet and inconspicuous; and as soon as the young begin to appear, about the middle of August, they are as numerous as ever."

Nesting.—Although not the first to report it, Dr. Mearns (1890) was the first naturalist to find the nest of the red-faced warbler. He describes the event as follows:

> On the 19th of June, 1886, I was encamped on a southern slope of the Mogollon Mountains, about five miles within the pine belt, in what has been designated the Great San Francisco Forest. Following a small stream into a little cañon between whose rocky walls stood groups of towering spruces and of aspens, the ground beneath thickly sprinkled with violets, strawberries, honeysuckles, and columbines, I entered a side ravine and had stooped to gather some flowering honeysuckles when a little bird was flushed from its nest upon the side of the bank, close to the trunk of a large spruce. Alighting in a young spruce tree, it uttered a sharp, hard *chip*. It was the first Red-faced Warbler I had ever seen; and its red face, black cap, gray back, and white rump suggested to my mind a miniature of the European Bulfinch. The bird was so fearless, and the place so confined, that I had some difficulty in securing the specimen in good condition. The male was not seen. After a close search an old nest was discovered on the ground; and I was about to conclude that it belonged to my bird and was as yet unfinished, when I descried a small opening close beside it among the stones and pine needles; on parting some blooming honeysuckles (*Lonicera ciliosa*) and moss, I discovered the nest,—most artfully concealed. In it were four eggs, containing small embryos which were easily extracted, the shells being thick and hard. The nest rested on a mass of dry leaves and spruce needles, and was entirely covered up and concealed by the honeysuckles. It is well built, being composed of a neatly felted mass of plant-stems and strips of fine bark, lined with soft vegetable fibres and cow-hairs.

W. W. Price (1888) was the first to report and describe a nest of the red-faced warbler, which he found in Ramsey Canyon in the Huachucas on May 31, 1888; his nest "was placed on sloping ground in a slight hollow and contained four fresh eggs." He had seen the bird fly to a clump of columbine which grew on the bank of a creek.

> A few sprays of the columbine hid the nest so completely that had not the bird been frightened and directly off from it, I should not have found it. * * * The structure was a very poor attempt at nest-building, and made of such loose material that it crumbled to fragments on being removed. The chief substance was fine fibrous weed stalks, while the lining consisted of fine grass, rootlets, plant fibres, and a few hairs. Skeleton leaves and bits of fine bark were scattered sparingly throughout the nest. Leaves and other rubbish had drifted with the wind or had been scratched up all around, to a level with the rim, so that one could hardly see where the nest proper left off. Inside the nest was about two and one half inches wide by one and one half inches in depth; outside it was about five inches wide by three inches in depth. The ground on which the nest was placed was so damp that the bottom part of it was badly decayed.

In the same region, Swarth (1904) found a nest that "was well concealed under an old rotten log, on a steep bank by the side of a trail, and could never have been seen had not the bird darted from the nest when it was approached." Howard's (1899) first nest was "on a side hill under a tuft of grass." The only nest that I have ever seen was also in a branch of Ramsey Canyon; we had previously seen the bird go to the nest while building it, and on May 26, 1922, we photographed (pl. 72, lower) and collected the nest with a set of four fresh eggs. The nest was located on a wooded open slope, close to a trail, and was in a depression in the ground at the foot of a tiny oak sprout, among a litter of fallen leaves and partially under some grass and other herbage, but it was not any too well hidden. It was made of dead leaves, dry grasses and fine strips of inner bark of cedar, and was lined with fine grass and horsehair. All of these Huachuca Mountains nests were at elevations ranging from 7,000 to 8,500 feet.

In the Santa Rita Mountains, Dr. Sutton (1943) found the red-faced warbler nesting in the aspen copses at an elevation of about 8,000 feet; a nest containing small young was found on May 29 "on the ground in a low bank under aspens."

One of the five nests of this warbler in the Thayer collection in Cambridge, was taken by Virgil W. Owen in the Chiricahua Mountains, Ariz., from the side of a bank in a narrow canyon, "in a depression under a projecting rock, which was overhung by a bunch of grass which entirely concealed both rock and nest." The main body of the nest is made externally of a large number of coarse pine needles and internally of grasses; it is lined with the finest of plant fibers and a quantity of reddish brown and white cow hair. Another is made externally of many coarse strips from heavy weed stalks, and still another was made mainly of strips of cedar bark, the latter composing most of each nest. I suspect that the lining in some of these nests may be deer hair, as these animals are fairly common there.

Eggs.—The red-faced warbler seems to lay three or four eggs to a set. The eggs are ovate, some tending to short ovate or elongate ovate, and have only a slight gloss. They are white, finely and delicately speckled with "auburn," "Mars brown," or "snuff brown," with undermarkings of "dusky drab." In general the markings are very fine and few seem to be large enough to be called spots or blotches; sometimes they are so light as to be almost imperceptible. The speckles are frequently scattered over the entire egg, although there is usually a concentration at the large end. The measurements of 44 eggs averaged 16.5 by 12.7 millimeters; the eggs showing the four extremes measure **17.9** by 13.0, 16.6 by **13.5, 14.3** by 12.2, and 15.3 by **12.0** millimeters (Harris).

Young.—We have no information on the incubation of the eggs or on the care and development of the young.

Plumages.—I have seen no small nestlings, but the fully grown young bird in the juvenal plumage is very dull-looking, with no trace of the red face. The upper parts, including the top and sides of the head and the back are uniform sooty brown, sometimes browner on the crown or more buffy on the nape; the rump is white; the wings and tail are as in the adult, except that the middle and greater wing coverts are tipped with buff, forming two narrow wing-bars; the throat and breast are brownish gray, becoming whitish on the abdomen.

The postjuvenal molt begins in June; a specimen taken June 13 shows a few black feathers coming in the crown and a few red feathers on the forehead, chin and sides of the neck. I have seen this molt in progress on birds taken June 21 and July 6 and 9; and I have a bird in my collection, taken July 13, that has completed the molt into the first winter plumage. This molt apparently involves all the contour plumage and the wing coverts, but not the rest of the wings or the tail. The sexes are alike in the juvenal plumage.

The first winter plumage is much like the winter plumage of the adult of the same sex, but the plumages of the young birds are always duller than those of the corresponding adults, the red being much paler or inclining to flesh color, the nuchal patch tinged with buff and the gray of the upper parts browner. We have no specimens showing a prenuptial molt; what specimens we have indicate that the dull, first winter plumage is worn until the following July; at least, I have seen what were apparently one-year-old birds molting out of a first winter plumage on June 27 and on July 9. If there is a partial prenuptial molt, it must occur while the birds are in winter quarters, and specimens from there are scarce.

Adults have a complete postnuptial molt in June, July, and August; I have seen the beginning of it as early as June 10; Swarth (1904) says it takes place in August. The June birds I have seen are all in worn plumage, and the August birds I have examined are in fresh plumage. In the fresh fall plumage the white of the nape, rump, and under parts are often tinged with pink, which gradually fades or wears away during the spring.

Food.—Nothing seems to have been published on the food of the red-faced warbler, which is probably largely, if not wholly, insectivorous. Its method of feeding, as described under "Behavior," indicates a diet similar to that of other wood warblers.

Behavior.—H. W. Henshaw (1875) wrote in his notebook:

> While collecting in the early evening in the pine woods, a few angry chirps coming from the thick foliage of a spruce attracted my attention, and in a moment a robin flew out in hot haste closely followed by a small bird, which after a short chase returned, and with a few satisfied chirps called together several young, whose presence I for the first time was thus made aware of. The old bird immediately began to search for food, moving like a Chickadee over the

> limbs, and flying out now and then for a short distance to snap up an insect, which was instantly given to one or the other of the several young that, with beseeching notes and cries, followed the old one about as it moved from one part of the tree to another. * * *
>
> Just a month later [in August], on visiting Mount Graham, I not only saw the species again, but it proved to be a common bird of this locality, flocks of ten or fifteen not being unusual among the pines and spruces; it frequented these trees almost exclusively, only rarely being seen on the bushes that fringed the streams. Its habits are a rather strange compound, now resembling those of Warblers, again recalling the Redstarts, but more often perhaps bringing to mind the less graceful motions of the familiar Titmice. Their favorite hunting places appeared to be the extremities of the limbs of the spruces, over the branches of which they passed with quick motion, and a peculiar and constant sidewise jerk of the tail.
>
> When thus engaged, especially when high overhead, they might easily be passed by, as a busy group of Titmice intent only on satisfying their hunger. They appear to obtain most of their food from the branches, seizing the insects when at rest; but they are abundantly able to take their prey on the wing, and accomplish this much after the style of the Redstarts. Their disposition seems to prompt them to sociability with other species, and occasionally I found them accompanying the Audubon's Warblers, and imitating them in their short flights from tree to tree, occasionally paying flying visits to the fallen logs and even to the ground.

Dr. Walter P. Taylor tells me that the red-faced warbler is not shy, and "is characterized by a curiosity that usually discloses it to view and enables one to really see it much more easily than is the case with many or most other warblers." He saw one hawking for insects, making two sorties in the air while he watched it; it has a peculiar "flitty" flight. The birds that he saw in the Catalina Mountains stayed more in the aspens than in the pines. But he noted one in the Chiricahua Mountains in the oak brush just below the pines.

Voice.—Dr. Taylor refers to the song in his notes as quite close to that of the yellow warbler; he calls it a whistled song with variations, "*a tink a tink a tink tsee tsee tswee tsweep*," and says that it is "more ringing and bell-like than that of Grace's warbler, which is often associated with it in the yellow pines." He says that the *chip* call-note is conspicuous, and he mentions another note as *psst.* Henshaw (1875) says: "Save in being rather louder and harsher, their chirps resemble the notes of the Yellow-rump Warblers."

Field marks.—A gray bird with a black cap, a red face and throat, a white rump, and white wing bars, could not be mistaken for anything but a red-faced warbler. No other North American bird looks at all like it.

Winter.—Dr. Alexander F. Skutch contributes the following notes: "On the Sierra de Tecpán, in west-central Guatemala, the red-faced warbler wintered in small numbers from September 13 to March, chiefly in the mixed forests of pine, oak, alder, arbutus and other broad-leafed trees, between 7,000 and 9,000 feet above sea level. These pretty warblers were usually found in the mixed flocks of Townsend's warblers and other small birds, only one or more rarely two in a flock. When there was a single red-faced member of the company, it was nearly always silent; but when two chanced to be together, they would usually be singing. On September 29, 1933, soon after the return of the red-faced warblers to the Sierra, I came upon two of them foraging in the same alder tree. They sang over and over a clear, mellow warble, as fine a song as I have heard of any member of the family, and twice welcome in those dreary, misty, rain-drenched days at the height of the wet season, when scarcely any bird sang. They continued to repeat their songs as they foraged, sometimes simultaneously, sometimes answering each other, and kept this up for perhaps half an hour. Just as I started to walk away from them, I noticed that they had flown together and were fighting. After a few moments, they separated and each went his own way, repeating his song.

"On a number of other occasions I found two individuals together; one or both—doubtless depending on their sexes—would be singing; and usually, if I waited long enough, one would drive the other away. The victorious bird might sing a little hymn of triumph upon the retreat of his rival, but soon would fall silent, and forage in peace among his companions of other species. These singing bouts were all staged during the fall months; from December onward, when the birds were well settled in their winter home, I found them alone and silent; until in March they resumed their beautiful song in anticipation of their departure for their northern nesting grounds.

"Such singing in rivalry has been paralleled in my experience by other migratory birds which are solitary during the winter months, including the yellow warbler, the black and white warbler, the blue-headed vireo and the blue-gray gnatcatcher, and by the males of non-migratory warblers which are solitary at this season, as Kaup's redstart (*Myioborus miniatus*), or of those which remain paired and continue to defend their territory, as Delattre's warbler (*Basileuterus delattrii*).

"In March, long before the majority of the migratory warblers, the red-faced warbler vanished from the Sierra de Tecpán. Except on the plains of Chimaltenango at the foot of the Sierra, I have not met this bird in other parts of Guatemala."

DISTRIBUTION

Breeding range.—The red-faced warbler breeds **north** to central and central eastern Arizona (30 miles south of San Francisco Mountains, Mogollon Plateau, and Camp Apache) and southwestern New Mexico (Mogollon Mountains, Powderhorn Canyon, and probably Fort Bayard). **East** to southwestern New Mexico (Fort Bayard) and northwestern Chihuahua (probably Barranca). **South** probably through the highlands of Mexico to southern Guatemala.

Winter range.—It winters in southern Mexico from Morelos (Cuernavaca) and Veracruz (Jalapa) to northern Oaxaca (La Parada and Cinco Senores).

Migration.—A late date of spring departure is: Guatemala—above Tecpán, March 5.

Early dates of spring arrival are: Texas—Water Canyon of the Magdalena Mountains, April 19. New Mexico—35 miles northeast of Silver City, April 19. Arizona—Tucson area, April 9; Willow Creek, May 3.

An early date of fall arrival is: Guatemala—above Tecpán, September 13.

Late dates of fall departure are: Arizona—San Francisco Mountains, September 4; Chiricahua Mountains, September 21. New Mexico—Little Rocky Creek, August 21.

Egg dates.—Arizona: 12 records, May 6 to June 19; 12 records, May 29 to June 7, indicating the height of the season (Harris).

WILSONIA CITRINA (Boddaert)

HOODED WARBLER

PLATES 73–75

HABITS

Dr. Chapman (1907) introduces this pretty warbler with the following words of well-deserved praise: "Its beauty of plumage, charm of voice, and gentleness of demeanor, make it indeed not only a lovely, but a truly lovable bird. Doubtless, also, the nature of the Hooded Warbler's haunts increase its attractiveness, not merely because these well-watered woodlands are in themselves inviting, but because they bring the bird down to our level. This creates a sense of companionship which we do not feel with the birds ranging high above us, and at the same time it permits us to see this exquisitely clad creature under most favorable conditions."

The hooded warbler makes its summer home almost entirely within the eastern half of the United States, extending its range only slightly into Canada, in southern Ontario. Being a forest-loving bird, it is much less common between the Mississippi River and the Plains than it is in the more heavily forested regions east of that river. It reaches its eastern limit in extreme southern New England, beyond which it occurs only casually. I have found it breeding commonly in southern Connecticut, where the forested slopes and the valleys of small streams support a luxuriant growth of mountain laurel and other undergrowth.

I know of another place in Rhode Island where a few pairs breed in a fine old, mature mixed forest, watered by tiny streams, that protects in its shady ravines and hollows a similar undergrowth; in this same cool forest retreat, we find the Canada warbler breeding near the southern limit of its summer range, save at the higher elevations of the Alleghenies.

Samuel F. Rathbun writes to me: "When my home was in west-central New York, about thirty miles from Lake Ontario, a friend and I made a camping stay of ten weeks in July and August, on the end of a projection of the mainland which was bounded on two sides by enclosed bays. This extension of land, about three-quarters of a mile long and in places a quarter of a mile wide, was heavily clothed with a forest of hardwood trees of the highest type, beech, hard maple, basswood, hickory, and here and there a little hemlock. Inside the forest were many open spaces, large and small, thickets of all sizes, some dense and some sparse, and many vistas where the wind and sunshine had free play. We soon found that the hooded warbler showed a predilection for this type of forest, for about fifteen pairs of birds used it as a summer home. During our stay we were never out of hearing or sight of a hooded warbler."

In the central Allegheny Mountain region, according to Maurice Brooks (1940), "these birds show a preference for areas of deciduous timber, light or heavy. They occur in southern mixed hardwoods, oak-hickory, northern hardwoods, and in 'chestnut sprout' areas. On Cheat Mountain they nest at 3,500 feet, and in Giles Co., Va., they breed at 4,000 feet."

Dr. Arthur B. Williams, of Cleveland, Ohio, has very kindly sent me some extensive notes on the habits of the hooded warbler, based on 15 years of observation in the Cleveland region, where the species is evidently abundant and is increasing in numbers and expanding its range. "In the Cleveland region the hooded warbler may be found during the breeding season in most mature beech-maple woodlands, seeming to prefer those which border on the river valleys where there is an abundance of moisture. It nests not only in the ravines and gulches in such woodlands, but also throughout the more level and open stretches of woodland where there is an understory of small beech and maple seedling trees. Characteristics of this forest are reduction of light, reduction of wind movement to a minimum, reduction of evaporation rate by 55 percent as compared with adjoining open field, and a high relative humidity of from 80 to 90 percent during the breeding season.

"In the forest community I studied most thoroughly, an average of 14 pairs of hooded warblers nest in an area of approximately 65 acres. In this community the warbler takes its place in a group of

18 species of nesting birds, the most common of which are the red-eyed vireo, wood thrush, redstart, ovenbird and scarlet tanager. In this group the hooded warbler usually ranks third or fourth in abundance."

The above accounts are fairly typical of the more northern habitats, but near the southern limits of its breeding range the hooded warbler seems to favor more swampy environment. Andrew Allison wrote to Dr. Chapman (1907) that, in Mississippi, it inhabits "low, heavily shaded woods, with thick undergrowth. Where convenient cover, such as a brake of switch-cane, extends to the border of the woods, the bird has no objection to an open, light, situation; and along the Gulf coast, where the only swampy situations are the narrow 'baygalls,' the thickets of rose-bay (*Illicium*) and azalea afford sufficient seclusion for a few. Damp woods such as are afforded by river and creek bottoms, however, are more favored."

S. A. Grimes (1935) says of its haunts in northern Florida: "A good-sized, poorly drained swamp, heavily forested with ash and maple, with a dense undergrowth mainly of fetterbush, red titi, and the seedlings and sprouts of several species of lowland trees, and such vines as Virginia creeper, smilax, and ivy, is evidently best suited to the hooded warbler's requirements. In such places it is usually the most abundant bird throughout the spring and summer, and it is not exceptional to hear, from one point, as many as five or six males singing at one time. In the swamps most favored there is commonly a breeding pair every fifty to one hundred yards in any direction. I have found occupied nests only fifty yards apart."

Spring.—Dr. Chapman (1907) says that the hooded warbler "reaches the United States by a flight across the Gulf of Mexico, avoiding the West Indies and (for the most part) southern Florida." This statement is doubtless correct, for there seems to be only scattering records for Key West, the Tortugas and points on the west coast of Florida. Howell (1932) calls it an "abundant migrant and a common summer resident in northwestern Florida south to the lower Suwannee River." Furthermore, M. A. Frazar (1881) reported "large numbers" seen 30 miles south of the mouth of the Mississippi, flying north toward the river, suggesting that they may have come straight across the Gulf from Yucatán. There seems to be a heavy migration, also, along the coast of Texas.

In northern Ohio, according to Dr. Williams (MS.), "the first week in May usually sees the arrival of the first hooded warblers from the south and within a few days thereafter the entire nesting population is present. The males appear first, but the females are close upon their heels. The males are in song from the moment of their arrival, though their first songs are not so complete or well-developed as they shortly become. Nesting territories are immediately occupied, and the limits of these correspond closely from year to year. The male patrols the territory regularly. His presence and movements are advertised by his song, which in May and June is almost continuous. He has no regular singing post, but sings as he moves back and forth within the limits of his chosen territory. This is a regular part of his behavior and is thoroughly done. If you approach, he will attempt to lead you away by singing ahead of you. If you sit down and remain motionless, he will quietly approach to look you over. Nesting territories which I have measured vary from 300 by 400 feet to 300 by 700 feet.

"While the male is easily seen and his progress followed by ear, the behavior of the female is quite the opposite. She drops out of sight immediately, and unless she is especially sought for and routed out, the record of observed birds is likely to include only males. She does not sing, but if alarmed or anxious will betray her presence by the characteristic *chip* note, often repeated at regular intervals. Since the male uses the same note however, one must actually see the female to be sure of her presence.

"Both birds will defend the nesting territory. I have seen them unite to drive out such an innocent intruder as a migrating black-throated blue warbler. The hooded warbler holds very closely to its chosen territory, and second or third nests are located not far from the first. The last birds to be found in the area without young in late September are still resident in the territories occupied by them in May."

Nesting.—Rathbun (MS.) says of its nesting habits in western New York: "All the nests of the hooded warbler found by me were placed at an average height of from 2 to 3 feet above the ground, with the exception of two which were about twice that height. In every case the nests were placed in the lowest fork of a beech sapling well within a small thicket. Invariably, at first sight, it resembled a small cluster of dead leaves caught up by the wind and lodged in the fork. On this platform of dead leaves the nest was securely placed. In each case the nest could not be detected by looking directly at the thicket. I found the easiest way to locate a nest was to place my head close to the ground, scan the low open spaces and look for a clump of leaves, which sooner or later proved to be a nest.

"The hooded warbler builds a neat, compact, and nicely woven nest, outwardly constructed of dry plant fibers, some quite long and some shorter, from the outside of dead plants. The substantial lining is composed of fine, dry, soft grasses, bits of plant fibers and other soft material, with occasionally a few horsehairs, to aid in holding the lining in place."

In southern Connecticut, the nests of the hooded warbler are usually built in the low, dense thickets of mountain laurel (*Kalmia latifolia*), which is locally abundant there, often in extensive patches, in well-shaded spots. Judge J. N. Clark (1882) gives the following good description of such a nest:

> Pieces of yellow birch bark, beech and chestnut leaves carefully matted and bound together and to the triangular crotch, formed the base of the structure, rounded and neatly finished at the top with the inner bark of chestnut and cedar, with fine grass and scales from beech buds and a little fern down mixed in, and all secured compactly together with spider webs. I speak advisedly having seen the bird diligently gather the webs. Inside the nest was neatly and smoothly lined with mixed horsehair and very fine grass. Largest outer diameter three inches and a half, inner diameter two inches, and depth two inches, and built in a little kalmia bush about fifteen inches from the ground. This description will answer for most of the many nests I have found of the species, with varying quantities of birch bark and fern down, invariably in a kalmia bush.

T. E. McMullen has sent me the data on 20 New Jersey nests; 14 were in small hollies in thick, dry or swampy woods; others were in pepper or huckleberry bushes, or in laurels; the heights above ground varied from 10 inches to 3½ feet. Dr. George M. Sutton (1928) mentions a very unusual nest in Pymatuning Swamp, Pa., "at the surprising height of eighteen feet from the ground in a slender upright shoot growing out from the trunk of a large beech tree."

In my collection are 22 sets of eggs from North Carolina; 5 of these were in oak saplings, 3 in myrtles, and 2 each in alders and hollies; the others were in various saplings, bushes, and brier patches; they were found at heights varying from 10 inches to 4 feet. In Georgia and South Carolina, the nests are often built in canes, as well as in low bushes, seldom as much as 5 feet up. In northern Florida, according to Grimes (1935)—

> the site of the nest may vary considerably, but one feature of the nest itself is quite consistent—its inconspicuousness. I have seen many nests of this species in northeastern Florida and believe I am safe in saying that nine out of ten are built in the fetterbush (*Pieris nitida*) in this region. I cannot name a second choice, but have found nests in such other shrubs as the button-bush, swamp blackberry, wax myrtle, and red titi, and in seedlings of the laurel oak, water oak, swamp ash, and red bay. * * * I have seen one nest in a low fetterbush directly beneath the center of a large horizontal palmetto frond that shielded it from rain as well as from view.
>
> There is a good deal of variation in the size, shape, and even the general tone of the exterior of the nest. The type most often met with is small, compact, rather dark in appearance, and an inconspicuous object in its natural surroundings. Such a nest is made outwardly of dead leaves of swamp ash, red maple, smilax, and water elm held together with strips of bark, spider web, and the black, hairlike heart of dried Spanish moss, these materials forming the foundations and shell of the structure. The shell or framework is reinforced with a

strong lining of bark of the wild grape vine and cypress tree tightly bound together with spider web and threads of moss, like the outer wall. The innermost lining, on which the eggs rest, ordinarily consists entirely of the black, skeletonized Spanish moss, somewhat more generously supplied at the bottom of the nest than up the sides.

Dr. Williams (MS.) gives me the following account of nesting hooded warblers in Ohio: "The first nest of the season is carefully made and is a real work of art. It is made without hurry and may take as long as a week for completion. Preferred nesting sites may be grouped under four heads:

"1. Rather isolated sites in more open woods where suckers from the roots of beech or sour gum trees, young sugar maple saplings, plants of red-berried elder or maple-leaved viburnum, or even blackberry canes, which may occasionally be found growing in open places in the woods, furnish the actual support for the nest, while the birds seem to rely on the natural camouflage of construction to make the nest inconspicuous. These nests resemble so closely a wad of woods rubbish caught by accident in the low growth near the ground that they escape the attention of most woods prowlers.

"2. Already existing camouflage in the shape of dead leaves hanging near the ground seems to exert a real fascination for the nest-builder, and frequently determines the exact location of the nest. The nest itself simulates such litter so closely that it easily escapes attention if built in such a situation. It is interesting to note that a nest which I discovered in a dead beach top lying on the ground had its exact counterpart over 40 years previously in New York State, as described by J. H. Langille.

"3. Small ravines seem to offer attractive nesting sites, a favorite location being just over the edge so that the nest is just below the level of the surrounding ground. Thus it is well out of the way of the beaten paths which woodland animals often make along the ravine edges and it is well-screened by vegetation above it.

"4. Thickets of spicebush, choke-cherry, grape tangles, or luxuriant vegetation of herbaceous plants are sometimes chosen, and in such a situation the nest is screened from view on all sides. One such nest was discovered in the forked stem of a plant of blue cohosh, 16 inches from the ground.

"In the case of 99 nests which I have studied, the average distance from the ground to the rim of the nest was 25 inches. The highest was 63 inches, but this nest was in a small sugar maple growing in a ravine in such a way that the nest was practically at ground level at the ravine edge. The lowest nest was 7 inches from ground to rim. This was in a small Y-shaped sugar maple seedling in which the dead cane of a blackberry had become lodged.

"Nest construction conforms to a very definite pattern. First there is a wad of loose dead leaves or long plant fibers like the strips of inner bark of dead chestnut or the inner bark of small sugar maples stripped off by squirrels, though beech leaves and the skeletonized leaves of sugar maples most frequently enter into this foundation. This wad of loose material may be long if there is a long narrow crotch to be filled up, or relatively flat if the location includes some sort of platform or cradle as a nest support. Usually the location is in a fork, and often includes a dead branch which has fallen across the fork, thus providing additional support. In a depression in the center of this loose collection of leaves a thin but strong basket is woven, the materials most frequently used being the strong, flat strips of bark of the wild grape. Other materials may sometimes be used, but they all have the common characteristics of flatness and strength. There is always a well-formed rim, carefully worked, of long plant fibers bound about the upper part of the structure, and well fastened in most cases with insect or spider silk, to which, sometimes, masses of the scales of beech buds or dried catkins of oak or hickory, or the dried staminate blossoms of the beech, adhere. The lining is always of springy, rather hard, finely shredded plant material, quite often hair-like in character. Probably much of this is finely shredded inner bark of grape vine. Many of the attachments of the nest to its supports will be of spider webbing or at least be reinforced by spider silk. Often long streamers will be left hanging from the bottom of the nest or from the rim. Second or third nests are apt to be much more hurriedly constructed than the first ones of the season, and lack the care and attention to details bestowed upon the earlier ones. Of 84 nests studied, measurements averaged as follows: height (from bottom to rim) 75 mm.; outside width, 79 mm.; inside width, 36.5 mm.; depth (inside), 52.5 mm."

Eggs.—Three or four eggs, often only three, make up the set for the hooded warbler, very rarely as many as five. These are usually ovate, sometimes tending toward short ovate or elongate ovate, and they are only slightly glossy. The creamy white ground is blotched, spotted or speckled with "bay," "chestnut," "auburn," "carob brown," or "russet," with undermarks of "vinaceous-brown," or "brownish drab." The markings on some eggs are scattered over the entire surface, but generally they are more or less confined to the large end, where they tend to form a wreath. Some have such pale spots that they appear as freckles, or, again, they may be so dark as to appear almost black. The measurements of 50 eggs average 17.6 by 13.6 millimeters; the eggs showing the four extremes measure **19.1** by 13.8, 18.5 by **14.5**, and **15.2** by **12.7** millimeters (Harris).

Young.—Grimes (1935) says:

> The hooded warbler ordinarily rears only one brood each season in this area, but I have known some to build again a week or ten days after the young left the first nest and successfully bring off a second brood. * * * While the female hooded seems to assume the whole task of building the nest, the male has a part in incubating the eggs and brooding the nestlings. [See remarks under plumages.] They share equally the work of supplying food for the young, and when a second nest is started, the male takes over the care of the fledglings of the first brood until they are able to shift for themselves. It is a rather common occurrence to find a male being trailed all over the swamp by a clamorous brood of young as large as the parent himself. But I have noticed that they do not receive as much attention as they demand.

Eugene P. Odum (1931) made some observations on a nest near Chapel Hill, N. C., of which he writes:

> During the first three days after the young had hatched, the male fed on the average of six times per hour, and the female fed three times and brooded three times per hour, during the five hours of observation. The average length of brooding periods was about ten minutes. During the remaining days that the young were in the nest brooding was discontinued, and the male fed on the average of every ten and one-half minutes, and the female every fourteen minutes, in eight hours of observation. The nest was somewhat infested with lice, and the female often spent several minutes eating. The excretus was usually carried away.
>
> The young were hatched almost naked, but soon were clothed in a coat of gray down. By the eighth day, when their eyes opened, they were partly feathered, and were beginning to utter audible food cries, resembling those of other young warblers. Their food seemed to be entirely insects, many of which were caught on the wing. Large brown crane-flies formed an important item in the fare.

Dr. Williams (MS.) contributes the following information: "The incubation period is 12 days, and it is quite usual to find one infertile egg. The life of the young in the nest is 8 days or a little over. The young come off the nest before they are able to fly at all well, but they have remarkably well-developed legs and feet, are very active as climbers and scramblers, and seem to be quite self-reliant. At first they seek places where fallen tree tops or a tangle of decaying logs on the forest floor offer them a refuge. Here both parents continue to feed them, but they are soon on the wing and may be seen following the parent birds about begging for food.

"By no means are all pairs successful in rearing a brood at the first attempt. In a four-year study of the birds of a 65-acre tract it appeared that only one seventh of the pairs were successful in the first attempt. Nests are frequently disturbed or destroyed, apparently by predators. But the hooded warbler is a persistent nester. Second and third attempts are made if necessary, and I am of the opinion that only the advance of the season finally puts an end to the bird's efforts to get a family of young on the wing if previous efforts are not successful. One young hooded warbler in juvenal plumage and in a dying condition was found at a considerable distance from any known occupied nesting territory on August 22, apparently abandoned by the parent birds at this late date.

"During the nesting period the interest of both parent birds in the welfare of the nest and its contents is intense. Frequent visits are made to it, apparently with no other purpose than to assure themselves that everything is all right. Cooperation between the two parents in the care of the nest and young is developed to a high degree. In the case of one pair held under close observation during the entire nesting period, it seemed to be the job of the male to clean the nest. Sometimes the female, brooding the young, would signal for the male by giving a call, and on his arrival would stand on the rim of the nest watching him while he performed this duty. During incubation the male frequently brought food to the female, and she in turn would pass them on to the young beneath her. As to whether the male ever assists the female in incubating the eggs I am unable to say. Early in my acquaintance with the hooded warbler I thought I saw a male in the act of incubating the eggs in the nest, and I so recorded it. As I gained in experience and in familiarity with the species, I noted that some females had much more black on the head than others, and I am not sure that the incubating bird may not have been one of these well-marked females."

Plumages.—The downy young are described as gray, but Dr. Dwight (1900) calls the natal down pale sepia-brown. He describes the juvenal plumage, in which the sexes are alike, as "above, pale yellowish wood-brown, edged with Mars-brown, drab when older. Wings and tail deep olive-brown, edged with olive-green, brightest on the secondaries and tertiaries, the wing coverts edged with pale wood-brown, often darker. Below, primrose-yellow, washed with wood-brown on the throat, breast and sides. The three outer rectrices largely white on their inner webs."

He says that the first winter plumage is "acquired by a partial postjuvenal moult beginning the end of June which involves the body plumage and the wing coverts but not the rest of the wings nor the tail. Young and old become practically indistinguishable."

In the young male in first winter plumage, "the crown occiput, sides of neck, whole throat and part of the chin are jet-black veiled with narrow edgings of lemon-yellow most marked on the throat. The rest of the upper surface and the sides are bright olive-green; the forehead, sides of head, anterior part of chin, breast, abdomen and crissum are rich lemon-yellow; the forehead partly veiled with olive-green or dusky tips, the lores with black ones."

The first nuptial plumage is "acquired by wear which is not very obvious, the black areas losing the veiling yellow tips. The olive-green above becomes grayer and wear brings into prominence a slight grayish collar bordering the black 'hood.' " The adult winter plumage is "acquired by a complete post-nuptial moult the last of June and in July. In some cases scarcely distinguishable from the first winter but usually the yellow edgings are absent or very obscure. The black occupies the whole chin up to its apex and the yellow below is richer." The adult nuptial plumage is acquired by wear as in the young bird.

Of the female Dwight says:

> The plumages and moults correspond to those of the male, from which indistinguishable until the first winter plumage is assumed. This lacks the black of the male and is uniform olive-green above and lemon-yellow below, occasionally one or two black feathers being assumed on the crown. The first nuptial plumage acquired by wear is, of course, plain olive-green and yellow. The adult winter plumage assumed by a complete moult shows a variable amount of black about the head and throat. How much of the black is due to individual vigor and how much to successive postnuptial moults is a question not easily answerable. We know that some females in the breeding season are almost indistinguishable from males, and there are all sorts of intermediates from these mature birds down to those of the worn first winter dress, which are guiltless of black.

The fact that very old, or very vigorous, females sometimes assume a plumage that is scarcely distinguishable from that of the male casts some doubt on the statements made by some observers that both sexes incubate the eggs. Apparently, most, if not all, fully adult females have more or less black in the crown and throat. In this connection the reader is referred to remarks by Ridgway (1889) and to descriptions of the adult female by Ridgway (1902) and by Chapman (1907), all of which refer to this subject. For a detailed description of the immature plumages and molts, the reader is referred to an interesting paper by William Palmer (1894).

Food.—Forbush (1929) says: "Little is known of the food of this bird. Grasshoppers, locusts, caterpillars and plant-lice are taken by it, and it takes many small insects upon the wing, but what they are we know not." A. H. Howell (1932) states that "examination of the stomachs of 6 specimens from Florida showed the food to consist of flies, ants, wasps, beetles, bugs, moths and their larvae, caddis flies, round-worms, and spiders."

Most of the food of the hooded warbler is obtained on or near the ground in the forest undergrowth where it lives, but it subsists largely on insects caught in the air. It is an expert fly-catcher, an activity for which its bill and bristles are well developed, and it may often be seen darting up into the air for a passing insect, or, if not successful on the first dash, following the insect in its erratic flight until it is captured, much after the manner of the true flycatchers.

Behavior.—Mr. Rathbun writes to me: "The hooded warbler does not spend its life far above the ground. Rarely have I found it over

15 feet above ground, and then only when startled. Neither is it often seen on the ground. It prefers small semi-open thickets of beech and maple, where it nests. It is a lively bird, and is constantly moving from one thicket to another, at times following the edges and again in the densest part. It seems to have much curiosity, for if a person sits quietly in the woods, he will hear the constantly nearing sound of its sharp alarm note until finally the bird will peer from the foliage, from which it quickly flies if disturbed. It is an exceedingly active bird in every way and one may be sure that, if there is a hooded warbler in any wood, sooner or later its alarm note will be heard and the bird glimpsed."

Although this warbler spends most of its life in the lower story of the forest, it often rises to the treetops to sing, as William Brewster (1875) observes: "As the day advanced the males would frequently ascend to the tops of the forest trees, and sing many times in succession sitting perfectly motionless in one place, then with expanded wings and tail would sail to the next tree and sing again. * * * When among the low thickets they are restless and shy, keeping a considerable distance ahead however fast you may walk, and were it not for the loud song they would be most difficult to procure. At such times they have a habit, observable in others of the genus, of flirting up six or eight feet after an insect and dropping almost perpendicularly again with closed wings."

I should call the hooded warbler more retiring than shy. If actively pursued, it retires to the seclusion of its leafy retreats, but it can be approached quietly, and has been photographed successfully at its nest, where the male seems to be less timid than the female. Forbush (1929) tells of one that even followed a man about for a while; and he quotes Aretas A. Saunders as saying that "he saw a pair of these birds acting as if their nest was near-by, but he could not find it. He stayed to eat his lunch, and as he finished and was about to rise, the male bird suddenly dropped to a low bush and then flew directly at his head; as Mr. Saunders dodged, the bird's wing brushed his face. This seems remarkable, as this bird usually seems to be of a gentle disposition, though some rival males fight fiercely in the mating season."

Mr. Allison told Dr. Chapman (1907) of "a very interesting fight between two male Hooded Warblers, for the possession of a female; the two began the contest in a tree, fluttering down into the mud and water, and the upper one, who had the other by the head, was in a fair way to drown or disable his opponent, when we frightened them off."

A conspicuous habit of the hooded warbler, so common with the redstarts and some other fly-catching warblers, is the frequent fanning in and out of its showy tail feathers, making a striking display of the white areas, a directive rather than a concealing action. Referring to this, Francis H. Allen writes to me: "The constant opening and shutting of the hooded warbler's tail, showing the areas of white, is extraordinary. Sometimes the bird switches its whole body to right or left, and sometimes the tail is jetted up and down slightly, but the opening and shutting is constant and very rapid. It is a graceful bird, and the tail action is as easy as the flickering of a flame."

Voice.—Aretas A. Saunders contributes the following study of the song of this warbler: "The song of the hooded warbler is one of the loudest of the warbler songs, and clearest in musical quality. It is short, consisting of 5 to 11 rather rapid notes, averaging 7. A typical song begins with two or three 2-note phrases or single notes, and ends with two longer, strongly accented notes, the first high in pitch and the second low; *tawit tawit tawit tée tóo.*

"In 25 of my 38 records the last two notes are the highest and lowest pitches of the song. In 26 records these two notes are simple and distinct; in 7 records they are connected by a slur, *teeyoo.* In 3 records the last note is a downward slur, so that the ending is *tee toyo;* while in 2 records the last note is highest of the song, the ending being *tay tee.* The first notes are regular 2-note phrases in 21 records and single notes in 9, while the remaining 8 records are quite irregular.

"Pitch of the song varies from D''' to E flat''''. Individual songs have a range of pitch from one and a half to four tones, the average being about two and a half tones. Songs vary from 1 to 2⅗ seconds, mainly according to the number of notes they contain.

"The birds sing on spring migration and from arrival on the breeding grounds till July. The average date of the last song heard in 12 seasons in Allegany State Park, N. Y., is July 16; the earliest July 8, 1930, and the latest July 24, 1938. But the bird is rather uncommon and local there, and could not be heard daily, so that the average may be somewhat later than this. The song is occasionally resumed in late August and September."

Albert R. Brand (1938) found that the number of vibrations per second in the song of the hooded warbler varied from 5,850 on the highest notes to 2,925 on the lowest notes, with an approximate mean of 4,000.

Wayne (1910) says that, in South Carolina, the song period is portracted for more than 5 months; and Grimes (1935) hears the males singing "throughout the sultry days of July and August and until late September."

Dr. Chapman (1907) writes: "The song of the Hooded Warbler is distinguished by an easy, *sliding* gracefulness. To my ear the words *you must come to the woods or you won't see me*, uttered quickly, and made to run one into the other exactly fit the bird's more prolonged vocal efforts, though they are far from agreeing with the attempts at syllabification of others. The call is a high, sharp *cheep*, easily recognized after it has been learned." He quotes from Allison's notes: "There are two common songs, both uttered on every possible occasion in spring, when the woods are ringing with them. The most frequent is a short one of four syllables, *Se-whit, se-wheer;* the longer song may be rendered, *Whee-whee-whée-a-whée*, accented as marked. A sharper, very clear-cut *chirp* is sometimes to be heard late in the evening, about dusk."

To John N. Clark's (1882) ear the bird seems to say *Pe-ter Pe-ter Re-gis-ter*, sometimes repeating the *Pe-ter* three times, or only once, again saying just *Re-gis-ter*, with the accent on the *Re.*

Rathbun (MS.) writes: "The song of this warbler signals its arrival, and on any soft June morning which has a rising temperature and rather high humidity, this warbler's song will be given more or less incessantly and at its very best, the forest fairly ringing with its lovely song. As nesting time draws near, the song improves in quality and frequency; this will continue until shortly after the eggs are hatched, when a decline begins, ceasing altogether by August 1. The bird has two songs, each consisting of clear, lively and sprightly notes. One song is decidedly longer than the other and, in my opinion, is much the better of the two. It is composed of seven notes, quite rapidly given, the last note having a strong rising inflection and often ending abruptly. It is essentially a carefree song, musical, and often spiced with a little jauntiness, which in many ways perfectly reflects the actions of the bird. It also has a quality which enables it to be heard for a long distance. This warbler has an abrupt alarm note which is much used by both sexes not only as a warning note, but also to hold the members of the family group together."

Dr. Williams says in his notes: "In addition to the full song, and its variations and modifications, the hooded warbler on occasion uses a song of a *chip-chip-chippity* nature, somewhat comparable to the redstart's well-known vocal effort, and quite unlike the more usual song. When first heard, it seems as if it must come from the throat of quite another bird.

"The quite characteristic *chip* note, used by both male and female, has been described by most authors who have written about the hooded warbler. Some say that it has a metallic ring at the end, while others quite definitely say that it has not. The fact is that both are correct. The *chip* note may be delivered either with or without the ringing ending, and it more often lacks the ring late in the season than earlier. It may be distinguished from the cardinal's well known *chip* because it is louder and less sparrowlike, and has a ring at the end which the cardinal's note lacks. From the note of the Louisiana waterthrush it may be separated by the fact that it is not so loud. And it may be told from the chipmunk's *chip* because of its more even spacing, and its more usual ring, which the chipmunk's note lacks.

"During May and June the hooded warbler is one of the most consistent singers of the woods which he frequents. He is one of the last to stop at night as darkness comes on, sometimes continuing longer than the wood thrush, the scarlet tanager or the wood pewee."

Field marks.—The adult male hooded warbler is unmistakable, with its black hood and throat surrounding its bright yellow cheeks in marked contrast with its olive-green black and yellow under parts. There are no white wing-bars, but the outer tail feathers are largely white and are almost constantly displayed. The fully adult female is often much like the male in general appearance, as noted under Plumages, but young birds are mainly plain olive above and yellow below. The seasonal plumages are not strikingly different. The song is quite distinctive.

Enemies.—Dr. Friedmann (1929) says that this warbler is a rather uncommon victim of the cowbird; he had only ten records.

Harold S. Peters (1936) lists one louse, two bird-flies, and one tick as external parasites on the hooded warbler. Dr. Williams (MS.) says: "The raccoon, skunk, opossum, red squirrel, and pilot blacksnake are all regular prowlers throughout the areas where the hooded warbler nests. The barred owl and the blue jay have young to feed while the warblers are incubating their eggs and feeding their own young in the nest. The cowbird is a frequent visitor to hooded warblers' nests, slightly over 50 percent of nests found with eggs or young containing from one to three cowbird's eggs or young."

Winter.—Dr. Skutch contributes the following: "Very rarely recorded in southern Central America, the hooded warbler is one of the less abundant winter residents in the lowlands of Honduras and Guatemala. In northern Central America it is found on both the Caribbean and Pacific sides of the mountains, and in midwinter ranges upward to at least 3,000 feet above sea level. On September 28, 1933, I met a male on the Sierra de Tecpán at an altitude of 8,500 feet; but he was obviously a transient and did not linger; nor have I any other record of the species at so high an altitude. The hooded warbler frequents low, moist thickets and second-growth woodland, and like practically all birds of similar habitat, is found singly rather than in flocks. Wearing his bright nuptial attire through the year, the male hooded warbler is always a delightful bird to meet amid the low second-growth, and is sufficiently rare to make the encounter a memorable event. The birds arrive in Guatemala in September and remain until early April.

"Early dates of fall arrival in Central America are: Guatemala—Hacienda California (Griscom), September 22; Sierra de Tecpán, 8,500 feet, September 28, 1933; Colomba, September 29, 1934. Honduras—Tela, September 3, 1930. Late dates of spring departure from Central America are: Guatemala—Motagua Valley, near Los Amates, April 6, 1932."

DISTRIBUTION

Range.—Eastern United States, eastern Mexico, and Central America.

Breeding range.—The hooded warbler breeds **north** to extreme southeastern Nebraska (rarely); central Iowa (mouth of the Des Moines River; probably Grinnell, Mahoska County, and Burlington); central and northeastern Illinois (Havana, Glen Elyn, and probably Waukegan); southwestern Michigan (Kalamazoo County; probably Macataw, and Grand Rapids); northern Ohio (rarely Toledo, Oberlin, Cleveland, and Painesville); northwestern Pennsylvania (Erie); western and central New York (Gaines, Rochester, Oswego, Baldwinsville, Stockbridge, and Cincinnatus); rarely to southern Massachusetts (Springfield and Dighton); and southern Connecticut (Newton, New Haven, and Preston). **East** to southern Connecticut (Preston); southeastern New York (Greenwood Lakes, Highland Falls, and Palenville); and south along the Atlantic coast to northern peninsular Florida (Old Town, Palatka, and Hastings). **South** to northern Florida (Hastings); the shores of the Gulf of Mexico, and southeastern Texas (Brazoria County, Kountz, and probably Matagorda). **West** to southeastern Texas (probably Matagorda); eastern Oklahoma (Cherokee Nation, Le Flore County, and McCurtain County); eastern Kansas (probably Fort Leavenworth and Burlington); and southeastern Nebraska.

Winter range.—It winters in southern Tamaulipas (Altimira); Veracruz and the Yucatán Peninsula south to southern Guatemala (Quetzaltenango, Patlul, and Ocós) and Costa Rica (Mount Cacaguatique, Volcán de Conchagua, and Guácimo; rarely central Panamá (Canal Zone).

The species is rare in southern Wisconsin (North Freedom, Appleton, Green Bay, and Two Rivers); and in southern Ontario (Rondreau, Woodstock, Toronto, and Cataraqui), and is only casual in South Dakota (Faulkton); North Dakota (Kenmare); Minnesota (Heron Lake and Minneapolis); Vermont (Rutland and St. Johnsbury); Maine (Fryeburg and Falmouth); and New Brunswick (Saint John). It is accidental in Jamaica; the Bahamas (Cay Lobos); Bermuda; Puerto Rico (Barrio Miradero); and the Virgin Islands (Saint Croix).

Migration.—Late dates of spring departure are: Volcán de Conchagua, March 3. Guatemala—Uaxactún, Petén, April 11. British Honduras—Mountain Cow, April 13. Mexico—Veracruz, Los Tuxtlas, March 30. Bahamas—Cay Lobos Light, April 15.

Early dates of spring arrival are: Virgin Islands, St. Croix, March 16, Cuba—El Guama, near Pinar del Río, March 25. Florida—Pensacola, March 16 (1947). Alabama—Mobile, March 24; Birmingham, March 28 (average of 10 years, March 30). Georgia—Atlanta, March 17. South Carolina—Yemassee, March 24. North Carolina—Windsor, March 31; Raleigh, April 5 (average of 26 years, April 17). Virginia—Cape Henry, April 9 (average, April 17); Rockbridge County, April 22. West Virginia—Bluefield, April 20; French Creek, April 24 (average of 17 years, May 1). District of Columbia—Washington, April 13 (average of 35 years, April 29). Maryland—Whaleysville, April 16; Patuxent Wildlife Research Refuge, Laurel, April 17. Delaware—Kent and Sussex Counties, April 3 (average of 14 years, April 15). Pennsylvania—Chambersburg, April 23. New Jersey—Cape May, April 25. New York—Niagara Falls, April 6 (1947); Westchester County, April 28 (1929). Connecticut—Fairfield and Hartford, May 1. Massachusetts—Martha's Vineyard, April 22 (1929); Northampton, May 2, (1929). Vermont—Rutland, May 4. Maine—Gorham, May 18. Louisiana—New Orleans, March 8. Mississippi—Deer Island, March 14. Arkansas—Huttig, March 19; Helena, March 31. Tennessee—Elizabethton, March 29 (1950); Nashville, March 31 (average of 13 dates, April 12). Kentucky—Bowling Green, April 13. Missouri—Dunklin County, April 2; St. Louis, April 17. Illinois—Chicago, March 27 (1950); Crab Orchard Lake, March 30 (1950); Blue Island, April 6 (1947); Rockford, April 6 (1950). Indiana—Lake County, April 14. Ohio—Put-in-Bay, March 28 (1950); Columbus, March 30, (1950); Toledo, April 9 (1947); average for central Ohio, May 2. Michigan—Detroit, April 6 (1947); Ann Arbor, April 7. Ontario—Toronto, March 28 (1950); Hamilton, March 30 (1950); Point Pelee, April 23. Iowa—Keokuk, May 7. Wisconsin—Milwaukee and Madison, March 27 (1950). Minnesota—Minneapolis, May 17. Texas—Cove, February 29; Houston, March 2. Oklahoma—Adair County, April 9. Nebraska—Omaha, May 7.

Late dates of fall departure are: Texas—Harlingen, November 7. Wisconsin—Dane County, September 12. Ohio—Columbus, October 10 (average for central Ohio, September 20). Indiana—Brookville and Lebanon, October 20. Illinois—Rockford, September 19. Missouri—St. Charles County, September 20; Dunklin County, September 28. Kentucky—Bowling Green, October 15. Tennessee—Athens, October 18. Arkansas—Arkansas County, October 7. Louisiana—

Baton Rouge region, October 26. Maine—Fryeburg, September 18. Massachusetts—Framingham, October 15; Marblehead, November 7. Rhode Island—Green Hill, September 17. Connecticut—Fairfield, September 22. New York—Orient, Long Island, September 28. New Jersey—Grantwood, Bergen County, November 8. Pennsylvania—Renovo, October 4. Maryland—Patuxent Wildlife Research Refuge, October 3. District of Columbia—Washington, October 1 (average of 10 years, September 14). West Virginia—Bluefield, October 8; Mount Lookout, Nicholas County, November 9. Virginia—Lynchburg, October 10; Cape Henry, October 16 (average, September 20). North Carolina—Raleigh, October 1 (average of 8 years, September 13). South Carolina—Charleston, November 11. Georgia—Savannah and Atlanta, October 28. Alabama—Birmingham, October 22 (average of 10 years, October 8). Florida—Pensacola, November 8. Cuba—Habana, September 24.

Early dates of fall arrival are: Texas—Galveston, August 27. Kentucky—Bowling Green, August 20. Mississippi—Deer Island, July 30. New York—New York City, July 19. Florida—Alligator Point, July 19; Key West, September 19. Cuba—Habana, August 27. Guatemala—Hacienda California, September 22. Honduras—near Tela, September 3. Nicaragua—Escondido River, September 24. Costa Rica—Guácimo, October 26.

Egg dates.—Connecticut: 42 records, May 22 to June 15; 23 records, May 27 to June 2, indicating the height of the season.

Georgia: 10 records, April 30 to June 13; 5 records, May 6 to 31.

New Jersey: 35 records, May 23 to June 14; 22 records, May 27 to 31.

South Carolina: 10 records, April 25 to June 26; 6 records, May 7 to 18 (Harris).

WILSONIA PUSILLA PUSILLA (Wilson)

WILSON'S PILEOLATED WARBLER

Contributed by Winsor Marrett Tyler

Plate 76

HABITS

Wilson (1832) and Audubon (1941) knew little about Wilson's pileolated warbler. Wilson apparently saw only a few migrating birds in New Jersey and Delaware, and Audubon, although he "found the birds abundant in Newfoundland," evidently did not discover its nest, as he describes it "amongst the thick foliage of dwarf firs, not more than from three to five feet from the ground."

Spring.—Wilson's warbler is one of the less common transients which pass through southern New England on the way to their more northern breeding grounds. We find the birds most commonly, perhaps, in swampy thickets or roadside shrubbery, although often they frequent well-grown woodlands. They are also at times fairly common visitors to our city parks—the Public Garden in Boston, for example—during the height of the spring migration, at which time they seem to be in full song.

In the open country the birds as a rule appear singly, but in the parks they may collect in considerable numbers; Horace W. Wright (1909) reports 10 birds in the Public Garden on a single day.

Whenever we meet the little bird our attention is sure to be drawn to it by its bright song, and then the eye is caught by the quick sprightliness of its demeanor, and a flash of sunny gold.

Nesting.—When we meet Wilson's warblers during the spring migration they may be on their way to the far north, for they breed to the limit of trees in northwestern and central Mackenzie as well as in the more southern Provinces of Canada and in northern Maine and New Hampshire.

In the southern part of its breeding range, where it has been studied carefully, it chooses for nesting the moist sphagnum bogs which are characteristic of this region—lonely, mosquito-infested wastes where, often associated with yellow palm and Tennessee warblers, it builds its nest on the ground.

Philipp and Bowdish (1917) thus describe a typical nest found in New Brunswick. "On June 16, a nest with five eggs, in which incubation was well commenced, was found in a boggy and quite wet clearing, surrounded by woods, with a considerable growth of small cedar, tamarack, spruce, and balsam saplings. This nest was built in the side of a moss tussock, resting in the angle formed by the abrupt side of the tussock and a little cedar, at the base of which the nest was placed. It was composed of moss, dead leaves, fine weed stalks and grasses, a little hair being mingled with the lining of fine, dead grass. It measured 3.50 x 1.50 inches in depth and 3.50 x 1.75 inches in diameter." Of the several nests found they say: "The nests are typical and readily distinguishable from other ground nesting warblers of the region, being very bulky for such a small bird."

W. J. Brown (MS.) sends this interesting account of the habitat of Wilson's warbler and the behavior of the birds at the nest, drawn from his long "friendship" with the bird, and his intimate knowledge of some 75 of their nests. "In the County of Matane, Gulf of St. Lawrence there is a sphagnum bog three miles in circumference and over a mile across. It is hidden on the west, east, and south by heavy evergreen woods, while the north end extends to the seacoast. Throughout this bog the ground is covered with deep moss, while black spruce, tamarack, and pine saplings are scattered over the whole region. The undergrowth is mostly Laborador tea and blueberry plants. Along the sides of this delightful barren are extensive open runs of alder, birch, and other mixed small timber, with many beautiful mounds interspersed. This region is the home of Wilson's warbler, and the bird is not only abundant in this bog, but throughout the entire County of Matane. I use the word 'friendship' advisedly in the case of the Wilson's because it is a confiding little bird, entirely lacking in fear during the nesting season. Should a warbler be flushed from a nest and you are in doubt as to its identity, wait a few seconds, and if it be a Wilson's, the bird will immediately return and exhibit a mild curiosity and a look of inquiry, flitting about noiselessly, and probably will enter the nest while the intruder is standing near by. I have never seen this warbler fail to return at once to its nest after being flushed. This action is characteristic and quite contrary to that of Nashville and Tennessee warblers.

"At the end of June, 1930, I flushed a Wilson's warbler from a nest in a hummock well-sheltered by a thick bunch of Labrador tea, and near a fringe of alders. The nest contained five young a few days old. I sat down 3 feet from the nest for 2 hours, with an old hat on my head. The bird, returning with insects, perched on my hat, then on my shoulder, and into the nest. This happened 20 times while I was anchored at the nest. The bird was fearless and tame and no doubt took it for granted that I was going to be a part of the landscape. Each time, on leaving the nest, she flew directly away. I did not see the male bird, but I heard him singing as he patrolled along the fringe of alders. I have found a nest of Wilson's warblers in this same mound every season for the past 10 years and I believe they become attached to old haunts. While I have been shuffling about with my camera and tripod, the birds are either perched on the camera and its base or are in the nest, sitting. This applies to most of the nests which I have observed.

"The majority of nests are sunk in moss at the base of alders or tamarack saplings at the edge of second growth. They are well hidden, and the bird sits close until almost trodden upon. They are sociable little birds with their own kind; three or four pairs may nest near together in a line of alders not over 75 yards long. The nests are simple affairs composed inside and out of a compact mass of fine, bleached grasses. After the young are hatched the male is often seen at the nest; before this time he patrols the alders, feeding and singing in a lazy way, with an occasional long flight to feed the sitting bird."

Of the occurrence of Wilson's warbler as a breeding bird in Maine, Knight (1908) says:

> That the species breeds frequently in the Canadian life areas of northern and central Maine seems well established, and that it has not been more often dis-

covered during the nesting season is on account of the favorite habitats being rarely visited by ornithologists. Full sets of eggs may be sought between June first and June nineteenth. There seems to be no doubt at all that a person acquainted with the habits of the present species and the Yellow Palm Warbler as well, can go into territory in northern and central Maine and find both species in many localities where other observers have failed to see them, provided that suitable tracts of spruce and hackmatack bog exist in the region.

Horace W. Wright (1911) speaks of the bird as "a rare summer resident, but becoming less rare" in Jefferson, N. H. He found the birds settled in Jefferson in the summer of 1905, and during the following 5 years, a little colony of six males was established. He reports also a nest and eggs found in 1909 by F. B. Spaulding in the neighboring town of Lancaster.

Eggs.—Wilson's warbler lays from 4 to 6 eggs to a set, most commonly five. These are ovate, with some tending toward short ovate, and they have only a slight lustre. They are white, or creamy white, finely speckled or spotted with "chestnut," "auburn," or "russet," with underlying markings of "light brownish drab" or "pale brownish drab." Sometimes the markings are scattered well over the egg, but there is a tendency to concentrate at the large end, often forming a distinct wreath of fine specklings. On the more boldly marked eggs the drab tones are quite prominent, whereas on the finely marked eggs they are often absent. The measurements of 44 eggs average 15.9 by 12.4 millimeters; the eggs showing the four extremes measure **17.3** by 12.7, 16.8 by **13.2**, and **14.0** by **11.4** millimeters (Harris).

Young.—Two nests under the observation of W. J. Brown (MS.) at Matane County, Quebec, contained five fresh eggs on June 18, 1939. "The young appeared in both nests in the early morning of June 29. On July 10 both nests were empty. On the basis of these records, the incubation period lasts 10 to 11 days, and the young remain in the nest for the same length of time."

Plumages.—Dr. Dwight (1900) describes the juvenal plumage, in which the sexes are alike, as follows: "Above, sepia or hair brown, mottled with sepia. Wings and tail dull olive-brown, edged with olive-green; wing coverts paler and indistinctly edged with buff. Below, primrose-yellow washed with pale wood-brown on the throat and sides."

The first winter plumage is acquired in July and involves a molt of all the body plumage and the wing coverts, but not the rest of the wings or the tail. The black cap is acquired, veiled with brownish feather tips; the upper parts become bright olive-green; the forehead, sides of the head, and the under parts become lemon-yellow.

The first nuptial plumage is acquired by a partial prenuptial molt, chiefly about the head and throat, young and old birds becoming indistinguishable.

A complete postnuptial molt occurs in July, at which an adult winter plumage is assumed that differs only slightly from the first winter plumage.

These remarks refer to the male. The plumages and molts of the female are similar, but the black cap is wholly lacking in the first winter plumage and more restricted afterward.

Food.—No comprehensive study of the food of Wilson's warbler has appeared in the literature, and practically nothing has been published in detail on the food of our eastern bird. Prof. Beal (1907) examined the contents of 53 stomachs of one of the western races of the species and found that 93 percent of the food was animal matter and only 7 percent of it vegetable. There is no reason to suppose that the eastern race has not a somewhat similar diet. Moreover, since our Wilson's warbler has been seen repeatedly foraging among the twigs and foliage of trees and shrubs, presumably in search of insects and their eggs and larvae, or darting out into the air to capture flying insects, it may be safely regarded as primarily insectivorous and hence mainly a beneficent species.

Dr. Alexander F. Skutch (MS.), speaking of the bird in Central America, says: "Among the peculiar foods of the Wilson's warblers in their winter home are the little, white, beadlike protein corpuscles which they daintly pluck from the furry cushions at the bases of the long petioles of the Cecropia tree. These minute grains, the chief nourishment of the Azteca ants that dwell in myriads in the hollow stems of the tree, are also sought by a number of other small birds, both resident and migratory."

Mrs. Edith K. Frey tells me that she has seen Wilson's warblers and several other species of wood warblers feeding on aphids in her shrubbery day after day until the pests were gone.

Behavior.—Wilson's warbler is a bright spot to bird watchers at the full tide of migration in May, and again in late summer, although we meet the bird less frequently during its southerly retreat from its breeding ground. It is a bright spot not solely because of brilliancy of plumage, but rather because it appears as a lively personality, standing out sharply as an individual among the quieter warblers. It gives us the impression of extreme alertness as it flits about in the trees and shrubbery, fluttering among the foliage, dashing into the air to capture flying insects, restless, full of energy, symbolizing, in spring, its characteristics by its brisk, vivid song. William Brewster (1936) thus pictures the bird:

> Wilson's Blackcap is a most interesting little bird, very like the Canadian Warbler in general behavior, but fussier and more animated. It feeds chiefly among low bushes (especially willows) near water and is incessantly in motion. It is much given to making short, abrupt upward flights to seize insects from the under sides of the leaves. It jerks its tail upward every few seconds and also

waves it from side to side much after the manner of a Gnatcatcher. It frequently darts out after flying insects and not infrequently descends to the ground to search for food among the fallen leaves. When on the ground it hops about briskly and often flutters its wings.

J. Merton Swain (1904) says of the bird on its breeding ground: "They feed in briery thickets, picking up insects very nimbly. They have the talents of a Flycatcher, and capture much of their food on the wing, but do not, like the Flycatcher, return to the same perch."

Voice.—Like most wood warbler's songs, which in the main are little more than a series of squeaky notes, or at most shrill whistles, the song of Wilson's warbler is neither beautiful nor artistic. Yet it stands out by reason of its brightness; the notes are delivered so emphatically, are so sharply cut and staccato, and follow each other in chattering haste so rapidly that the song has a distinctive quality and is easily distinguished from those of those other warblers which sing on about the same pitch. At times the song may suggest that of the yellow warbler, but the latter, in comparison, has almost a drawling delivery; at other times it may suggest that of the Nashville, but here again the staccato quality marks it; it sometimes recalls for a moment the song of the northern waterthrush, but as all the notes are very short and never isolated, the resemblance at once vanishes; occasionally there is a hint of the goldfinch's voice (I find this point mentioned more than once in my notes of the last quarter of a century), but the tone is too flat for a goldfinch—it lacks the sweet, musical ring.

The song is more or less varied, but there are not two distinct songs as in the case of some warblers. In a common form the pitch drops in the second half when, the notes becoming faster and more emphatic, the song changes into a sort of chatter. I have heard this form given over and over for half an hour or more with little or no change. More rarely the pitch at the end may return to the original pitch, thus dividing the song into three parts. Occasionally the song ends with a single, emphasized note, and frequently neither pitch nor tempo varies—a perplexing song at first, but the extreme liveliness of the notes soon identifies the author.

Gerald Thayer (Eaton, 1914) gives this accurate description: "Its song suggests somewhat in miniature that of the Northern water thrush although it is itself quite loud and rich, a bright, hurried, rolling twitter, suddenly changed into more of a trill, richer and somewhat lower in tone. The first portion of the song varies in length and richness, sometimes longer and fuller in tone, more often shorter and weaker than the second, while some individuals omit it altogether, uttering only the trill when the song is rather difficult to recognize. * * * The call note is a weak but ringing *tschip.*"

Aretas A. Saunders (MS.) sends the following: "The song of Wilson's warbler is mainly a series of rapid chatterlike notes, dropping downward in pitch toward the end. It is not especially musical in quality. The notes are short, staccato, and with marked explosive consonant sounds. I have had opportunity to record only songs heard on migration, and since the song is not often heard then, I have only 12 records. These have from 8 to 15 notes, averaging about 10. They vary from F‴ to C⁗ in pitch, and from 1⅖ to 1⅘ seconds in length. Individual songs have a pitch range from one to two and a half tones, averaging about one and a half. In most of the records the notes are all on the same pitch and of equal length at the beginning, only the last 3 or 4 notes dropping in pitch, and sometimes becoming faster in time. In all but 2 records the last note is lowest in pitch, and in these exceptions it is the next to the last note that is lowest. A typical song would sound like *wititititititatoo*."

Ralph Hoffmann (1899) reports: "On the 2d of November I found a female Wilson's Blackcap in Belmont [Mass.]; the bird stayed in the same locality till Nov. 20, and uttered when startled a curious wren-like *kek,kek*, which I have never before heard."

Field marks.—Although the identification points in the plumage of Wilson's warbler are mostly negative—absence of wing bars and tail spots, and no streaks or lines in the plumage—the tiny bird is distinctive in the field. The black skull cap is often difficult to see, but the contrast between the plain darkish back and the brilliant, plain under parts is an aid in identification, and even more helpful is the unmarked, bright yellow side of the head with the black eye, a dot in the center.

Enemies.—Wilson's warbler presumably has few enemies aside from danger during its long migration and the hazards of a ground nest. Wilson's warbler, like the Tennessee and yellow palm, is apparently rarely molested by the cowbird. The three species breed in the same environment, often in the same swamps, where, it may be supposed, cowbirds seldom go. Friedmann (1929) does not list the bird, but records the race *chryseola* as "a not uncommon victim of the Dwarf Cowbird in southern California."

Fall.—Of the bird in Cambridge, Mass., in the fall, William Brewster (1906) says: "During their return migrations, which begin late in August, Wilson's Blackcaps are decidedly less numerous—or at least conspicuous—than in spring, and also more given to haunting dry places. Indeed I have seen them oftenest at this season among oaks or pines growing on high ground. Most of them pass southward before the middle of September, but Mr. Ralph Hoffmann has reported finding a young bird in Belmont as late as November 20 (1898)."

Winter.—Dr. Alexander F. Skutch (MS.) sends to A. C. Bent the following comprehensive account of the bird as he has seen it during the winter in Central America: "All three forms of Wilson's warbler pass the winter months in Central America. Of these, the race that breeds in the Rocky Mountains, the pileolated warbler, appears from the determination of specimens to be far the most numerous. Yet since all three may occur in the same locality and it is difficult or impossible to distinguish them in the field, it seems best to treat them all under the name of the typical form.

"Arriving early in September in Guatemala, and about the middle of the month in Costa Rica, Wilson's warblers rapidly increase in numbers until they are among the most abundant of wintering warblers. They settle down for their long sojourn in a great variety of situations, from the warm lowlands up to the bushy summits of the higher mountains that are so cold and frosty during the nights of the northern winter. I have found them abundant even at 11,000 feet above sea level. They are far less common in the Caribbean lowlands than they become above 1,500 feet, and are distinctly uncommon on the Pacific side of Central America below 2,000 feet. But from these levels up to the tree line, there seems to be slight variation in their midwinter abundance, which is associated with the type of vegetation rather than with altitude. Everywhere the blackcaps haunt the bushy abandoned fields, neglected pastures, openings in the forest, hedgerows, and at times even the dooryard shrubbery. They avoid the sunless undergrowth of heavy forests, yet frequent the lighter woods of oak and pine in the highlands, and the thinner of the woodlands at lower elevations. Restless and sprightly, they flit tirelessly among the bushes in pursuit of tiny insects, constantly advertising their presence with their emphatic nasal *chip*.

"The period of absence of Wilson's warbler from Central America is brief. On the Sierra de Tecpán in the Guatemalan highlands, I saw the last one of the season on May 22, 1933. The first fall arrival was encountered on September 3 of the same year; four were seen on the following day, and by the fifth of the month, they were so numerous that it was hopeless to try to keep count of them. They had been absent only 3 months and 12 days. At Vara Blanca on the Cordillera Central of Costa Rica, the first appeared on September 18, 1937, and the last was seen on May 5 of the following year. They were present through the year, save for a period of 4 months and 13 days.

"Although at times Wilson's warblers are present on the bushy mountain slopes in such great numbers that they give the impression of being gregarious, they are in fact evenly distributed through the bushes. Where less abundant, they are seen singly rather than in flocks, for they are intolerant of the company of their own kind during the winter months. At times, in the highlands, a single individual of the species will attach itself to a mixed flock of warblers and other small birds. On the central plateau of Costa Rica, I would sometimes find a single Wilson's warbler keeping company among the coffee bushes with a pair of the pretty, chestnut-headed Delattre's warblers (*Basileuterus delattrii*), a resident species which remains paired and maintains a territory throughout the year. But perhaps more often the blackcaps pass the winter quite alone. On October 12, 1933, I came upon two male Wilson's warblers fighting earnestly on the ground in the garden of the house in which I dwelt on the Sierra de Tecpán. While I did not witness the beginning of the conflict and can only surmise its cause, it seems probable that this was a struggle for the possession of the garden in which it was staged. They separated a few moments after I came upon them; and I did not hear them sing, as migratory warblers will sometimes do under similar circumstances. As the date for their departure approaches, these long-solitary warblers tend to draw together in flocks for their northward flight.

"On April 27, 1933, I heard a Wilson's warbler singing in the Guatemalan highlands. Five days later, I found another caroling far more whole-heartedly, repeating several times over his simple but happy little lay, a rapid chipping gradually ascending in pitch. These songs hearalded their northward departure. By the latter part of April, few Wilson's warblers remain in Costa Rica, although they have been recorded as late as May 5. In Guatemala they linger somewhat later, a few individuals tarrying until past the middle of May. Long before they depart from Central America as a whole, these warblers appear to withdraw from the lower altitudes at which they are not uncommon earlier in the year, probably merely ascending the mountains to higher levels. Thus, in the lower Motagua Valley in Guatemala, at about 500 feet above sea level, I found them fairly abundant in January and February, but did not record them later. In the Pejivalle Valley of Costa Rica at 2,000 feet, I found a number in February, 1934, but failed to see a single one when I revisited the locality in April, 1941. In the Basin of El General, on the Pacific side of the same country, they may be exceedingly numerous at an altitude of 3,000 feet from their fall arrival until the following March, when they rapidly grow more silent and become fewer. In dry years they are seen in April only as rare transients, while in abnormally wet years they may remain somewhat more numerous. This local movement, well in advance of the main northward migration, is paralleled by that of the Tennessee warbler; it appears to be caused by increasing dryness or higher temperatures, or by the two in combination.

"Early dates of fall arrival in Central America are: Guatemala—passim (Griscom), September 11; Sierra de Tecpán, 8,500 feet, September 3, 1933; San Juan Atitán, September 8, 1934; Huehuetenango, September 11, 1934. Costa Rica—La Hondura (Carriker), September 22; Vara Blanca, September 18, 1937; San Miguel de Desamparados, September 20, 1935; El General, September 18, 1936.

"Late dates of spring departure from Central America are: Costa Rica—El General, April 22, 1936 and April 24, 1937; Vara Blanca, May 5, 1938; Juan Viñas (Carriker), April 19. Guatemala—passim (Griscom), April 26; Sierra de Tecpán, May 22, 1933."

DISTRIBUTION

Range.—North America and Central America.

Breeding range.—The pileolated warbler breeds **north** to northern Alaska (Kotzebue Sound, probably Barrow, and Fort Yukon); northern Yukon (La Pierre House); northwestern and central eastern Mackenzie (Fort MacPherson, Mackenzie Delta, and Fort Anderson); northeastern Manitoba (probably York Factory); northern Ontario (probably Moose Factory); central Quebec (Mistassini Post, Mingan Islands, and Mutton Bay); southern Labrador (probably Hamilton River, Cartwright, and Squasho Run); and Newfoundland (Saint Anthony, Lewisport, and Trinity). **East** to Newfoundland (Trinity); central Nova Scotia (Kings County and Halifax); and Maine (Machias). **South** to Maine (Machias, Augusta, and Fryeburg); northern New Hampshire (Lancaster and Jefferson); northeastern Vermont (Saint Johnsbury); southern Quebec (Sherbrooke); southern Ontario (Sudbury, Madoc, and Ottawa); northern Michigan (Baraga and Blaney Park); northern Minnesota (Mud Lake and Duluth); western Texas (probably Guadalupe, Davis, and Chisos Mountains); north-central New Mexico (Santa Fe Canyon); and southern California (Julian and Escondido). **West** to California (Escondido, Riverside, Mount Whitney, Eagle Lake, and Edgewood); western Oregon (Mount Hood and Fort Klamath); western Washington (Bellingham, Seattle, and Mount Rainier); British Columbia (Victoria); and Alaska (King Cove, Kodiak Island, Cordova Bay, Chitina Moraine, Sitka, Gravina Island, Norton Sound, and Kotzebue Sound).

Winter range.—This species winters **north** to southern Baja California (La Paz); southern Sonora (Tesia, and Alamos); Nuevo León (Monterrey, and Linares) and southernmost Texas (Santa Maria). **East** to southernmost Texas (Santa Maria); Tamaulipas (Victoria); Costa Rica (Guayabo, San José, and Cerro de Santa María); and Panamá (Veraguas). **South** to Panamá (Veraguas, Chiriquí, and Boquete); and Guerrero (Chilpancingo). **West** to Guerrero (Chilpancingo) and southern Baja California (San José del Cabo and La Paz).

The range as outlined is for the entire species of which three subspecies are recognized. The Wilson's pileolated warbler (*Wilsonia pusilla pusilla*) breeds from northwestern and central Mackenzie to Nova Scotia and New England, northern Michigan, northern Minnesota, southern Manitoba, central Saskatchewan and central eastern Alberta; the northern pileolated warbler (*W. p. pileolata*) breeds in northern Alaska, northern Yukon and northwestern Mackenzie, Montana, eastern Wyoming, southwestern Colorado, north-central New Mexico, and western Texas, and south from Alaska through the Rockies and mountains of the Great Basin to northeastern and central eastern California; and the golden pileolated warbler (*W. p. chryseola*) breeds along the coasts and coastal ranges from southwestern British Columbia, south through western Washington, western Oregon, to eastern and southern California.

Casual in Florida (Tallahassee, Sharpes, and Fort Myers); Missouri (Independence); and Mississippi (Gulfport).

Migration.—Late dates of spring departure are: Costa Rica—Basin of El General, April 24. Guatemala—above Tecpán, May 22. Baja California—Sierra San Pedro Mártir, May 21; Sonora—Rancho La Arizona, western foothills of Pajaritos Mountains, May 25.

Early dates of spring arrival are: Alabama—Florence, May 1. Georgia—Milledgeville region, April 13. South Carolina—Chester, May 10. North Carolina—Salisbury, May 8. Virginia—Charlottesville, May 4. West Virginia—Bee, April 24; French Creek, May 7 (average of 10 years, May 12). District of Columbia—Washington, May 1 (average of 38 years, May 8). Maryland—Baltimore County, May 4. Pennsylvania—Renovo, May 1. New Jersey—Long Valley, May 5; Union County, May 12 (average, May 15). New York—New York City, April 30. Connecticut—Hartford, May 3. Rhode Island—Kingston, May 8. Massachusetts—Huntington, May 1. Vermont—Wells River, May 6. New Hampshire—Monroe, May 5. Maine—Lewiston and Winthrop, May 7. Quebec—Montreal, May 13. New Brunswick—Saint John, May 15. Nova Scotia—Halifax, May 18. Newfoundland—St. Andrews, May 27. Labrador—Grand Falls, Hamilton River, May 31. Louisiana—Monroe, April 16. Arkansas—Rogers, April 27. Tennessee—Elizabethton, May 4. Kentucky—Bowling Green, April 18. Missouri—St. Louis, and St. Charles, April 29. Illinois—LeRoy, April 27; Chicago, May 6 (average, May 11). Indiana—Marion County, April 28. Ohio—South Webster, April 25; central Ohio, May 2 (average, May 11). Michigan—Ann Arbor, May 11. Ontario—Toronto, May 10; Ottawa, May 14 (average of 17 years, May 20). Iowa—Buchanan County, May 7. Wisconsin—Madison, May 4. Minnesota—Lanesboro and Minneapolis, May 2 (average of 39 years for southern Minnesota, May 10).

Texas—Brewster County and Victoria, April 1; El Paso, April 6. Oklahoma—Gate, April 22. Kansas—Douglas County and Lake Quivira, Johnson County, May 2. Nebraska—Hastings, April 26. South Dakota—Sioux Falls, May 3. North Dakota—Fargo, May 8; Cass County, May 11 (average May 17). Manitoba—Aweme, May 3 (average, May 18). Saskatchewan—Indian Head, May 14. Mackenzie—Mackenzie Delta, May 28. New Mexico—Glenrio, April 15. Arizona—Tucson, March 7; Holbrook, May 4. Colorado—Monon, Baca County, May 3. Utah—Uinta Basin, May 12. Wyoming—Laramie, May 2. Idaho—Moscow, May 11. Montana—Anaconda and Fortine, May 14. Alberta—Medicine Hat, May 17. California—El Cajon, March 8; San Francisco Bay area, March 12 (average of 22 years, March 24). Nevada—Charleston Mountains, April 30. Oregon—Newport, April 13. Washington—Lapush, April 10. British Columbia—Comox, Vancouver Island, April 14. Yukon—Carcross and Ross Post, May 22. Alaska—Kake, May 5; Nushagak, May 10; Kotzebue Sound region, June 3.

Late dates of fall departure are: Alaska—Nome, August 27; Nunivak Island, September 7. Yukon—Macmillan River region, September 16. British Columbia—Okanagan Landing, September 22. Washington—Seattle, September 25; Pullman, September 18. Oregon—Eugene area, September 24; Government Island, December 11. Nevada—Montello, and West Humboldt Mountains, Pershing County, September 20. California—Hastings Reservation, Monterey County, November 1; Eureka, November 20. Alberta—Warner, September 30. Montana—Sun River, October 7. Idaho—Moscow area, October 21. Wyoming—Parco, October 18; Laramie, October 16, November 10 and 11. Utah—North Creek, Beaver, September 26. Colorado—Pueblo, October 20. Arizona—Tucson, October 28; average of 5 years for Parker, Topock area, September 30. New Mexico—Apache, October 15. Mackenzie—Artillery Lake, September 5. Saskatchewan—East End, September 29. Manitoba—Aweme, September 21. North Dakota—Fargo, October 20; Cass County, September 19 (average, September 15). South Dakota—Faulkton, October 10 and 30. Nebraska—Red Cloud, September 28. Kansas—Gore County, October 9. Oklahoma—Cimarron County, September 23. Texas—Victoria, November 14; Cove, November 16, January 1. Minnesota—Montevideo, October 5; Minneapolis, October 20 (average of 10 years for southern Minnesota, September 21). Wisconsin—Racine, October 8. Iowa—Tabor, October 3. Ontario—Ottawa, September 25 (average, September 19). Michigan—Grand Beach, October 18; Hillsdale, December 8. Ohio—central Ohio, September 30 (average, September 24). Indiana—Monroe County, October 3. Illinois—Chicago, October 5 (average, September 19); Port Byron, October 11. Missouri—

Columbia, September 30. Kentucky—Bowling Green, October 1. Tennessee—Nashville, October 10. Arkansas—Rogers, October 7. Mississippi—Saucier, October 12. Louisiana—Cameron, November 21; Baton Rouge, October 24, December 20. Newfoundland—Tompkins, September 30. Quebec—Quebec, September 15. Maine—Jefferson, October 11. New Hampshire—Warren, October 3. Vermont—Clarendon, September 29. Massachusetts—Belmont, November 20; Groton, November 27; West Gloucester, November 29; Boston, December 3. Connecticut—Hartford, October 1; Windsor Hill, November 3. New York—New York City, October 31, November 22 and 25; Orient Point, Long Island, November 24. New Jersey—Sandy Hook, October 7; Union County, September 29 (average, September 25); Princeton, December 23. Pennsylvania—Laceyville, October 15; Radnor, December 7. Maryland—Baltimore County, and Patuxent Wildlife Research Refuge, Laurel, September 23; Snow Hill, December 22. District of Columbia—Washington, October 13 (average of 8 years, September 19). West Virginia—French Creek, September 30. Virginia—Charlottesville, October 6. North Carolina—Piney Creek, October 11. South Carolina—Mount Pleasant, November 9. Georgia—Fitzgerald, October 31. Alabama—Birmingham, October 6. Florida—Pensacola, November 11; Lake Jackson, December 19; Tallahassee, January 1. Sonora—San José Mountains, October 25.

Early dates of fall arrival are: Washington—Seattle area, August 14. Nevada—Charleston Mountains, August 13. California—Santa Cruz Island, August 29. Montana—Great Falls, August 17. Idaho—Moscow area, August 10. Arizona—Tucson, July 31. New Mexico—Willis, August 8; Cooney, August 20. North Dakota—Wilton, August 15; Cass County, August 16 (average, August 21). Nebraska—Gresham, August 20. Kansas—Douglas County, and Geary, Doniphan County, August 23. Oklahoma—Cimarron County, August 25. Texas—Austin region, August 6; El Paso region, August 27. Minnesota—Hibbing, August 13; Minneapolis, August 15 (average of 9 years for southern Minnesota, August 24). Wisconsin—Mazomanie, August 26. Iowa—Winnebago, August 17. Michigan—Sault Ste. Marie, August 24. Ohio—central Ohio, August 20 (average, August 27). Indiana—Lake County, August 28. Illinois—Chicago, August 17 (average, August 24). Missouri—La Grange, August 16. Kentucky—Versaille and Bowling Green, September 6. Tennessee—Knoxville area, August 12. Arkansas—Winslow, September 7. Mississippi—Bolivar County, September 10. Louisiana—Baton Rouge, September 11. Maine—Hog Island, August 6. New Hampshire—Hancock and Monroe, August 16. Vermont—Wells River, August 20. Massachusetts—Lynnfield, August 19. Connecticut—New Haven and West Hartford, August 27. New York—New

York City, July 26; Bayside, Long Island, July 31. New Jersey—Englewood region, August 15; Union County, August 20 (average, September 1). Pennsylvania—Crawford County and Pittsburgh, August 28. Maryland—Patuxent Wildlife Research Refugee, Laurel, August 17. District of Columbia—Washington, August 22. Virginia—Shenandoah National Park, August 19. North Carolina—Piney Creek, September 4. Georgia—Athens, September 2. Alabama—Birmingham, August 23. Florida—Pensacola, September 23. Cuba—western Cuba, September 24. Mexico—Sonora, Rancho La Arizona, western foothills of Pajaritos Mountains, August 16; Baja California—San José del Cabo, August 25. Guatemala—above Tecpán, September 3. Salvador—Monte Mayor, Volcán de Sociedad, October 6. Costa Rica—Basin of El General, September 18.

Egg Dates.—Alaska: 10 records, May 20 to July 3; 5 records, June 15 to 18.

California: 82 records, April 27 to July 4; 41 records, May 10 to June 10, indicating the height of the season.

Colorado: 17 records, June 2 to July 1; 9 records, June 12 to 20.

Maine: 2 records, June 4 and 22.

New Brunswick: 7 records, June 6 to 21 (Harris).

WILSONIA PUSILLA PILEOLATA (Pallas)

NORTHERN PILEOLATED WARBLER

PLATE 77

HABITS

The western representatives of *Wilsonia pusilla* are divided into two subspecies, the northern pileolated warbler (*W. p. pileolata*) and the golden pileolated warbler (*W. p. chryseola*). The former breeds from the northern tree limit in Alaska, southward along the coast to the Queen Charlotte Islands, and farther southward, mainly in mountain regions, as least as far as New Mexico and perhaps central-western Texas. Dr. E. W. Nelson (1887) calls it "one of the commonest of the brush-frequenting species in the north and extends its breeding range to the shores of the Arctic Ocean, where it is found breeding about Kotzebue Sound as well as along the eastern coast of Norton Sound wherever shelter is afforded." Dr. Herbert Brandt (1943) says: "In the Hooper Bay area the Pileolated Warbler confines itself to the brushy flanks of the Askinuk Mountains where it is a rather common breeder. Along the lower Yukon River, however, during early July I recorded it at every landing that we made as far up as Mountain Village."

Referring to its status in Montana, Aretas A. Saunders (1921) writes: "A common summer resident of the mountains in the western half of the state, and a common migrant in the mountain valleys and at the edge of the prairie region near the mountains. A rare migrant in the eastern part of the state. Breeds in the Canadian zone, in willow thickets along the mountain streams or bordering mountain lakes. West of the divide the Pileolated Warbler breeds in arborvitae forests."

It probably breeds in eastern Oregon, but Gabrielson and Jewett (1940) say that "the first actual Oregon nest remains to be discovered." According to Prof. Cooke (1904), "in Colorado it breeds commonly at timber line, ranging from 12,000 down to 6,000 feet."

The northern pileolated warbler is much like the eastern Wilson's warbler, but it is somewhat larger on the average and its coloration is brighter, the upper parts being more yellowish olive-green and the yellow of the under parts brighter. It is, however, not so brightly colored as the golden pileolated warbler that breeds in California.

Spring.—From its winter home in Mexico and Central America this subspecies makes a long flight to northern Alaska, and over a wide range, from the Pacific coast to the eastern foothills of the Rocky Mountains. It is a later migrant in California than the local breeding form. Mrs. Amelia S. Allen tells me that the golden pileolated warblers generally arrive on their breeding grounds in March or very early in April, sometimes as early as March 11. She says in her notes: "About the middle of May, after the breeding birds are busy nesting, migrating birds pass through on the way north."

Harold S. Gilbert writes to me: "On June 11, 1933, Mr. Everett Darr, of the Mazamas, found 200 frozen pileolated warblers scattered over the snow and ice at about 10,000 feet elevation, in the crater of Mt. St. Helens, Wash. He brought some of these birds to my office for identification. Apparently, during migration they had been swept up in a storm and frozen."

Nesting.—Herbert Brandt (1943) found five nests of this warbler in Alaska, of which he says:

> The nest of the Pileolated Warbler in the Hooper Bay area is found only in the vicinity of the willow and alder thickets that decorate the lower mountain slopes. Out in the cleared defiles and under the matted dead grass that never again rises from its supine position after being beaten down by winter's pressure, this little bird builds its home. The nest may be sunken flush with the mossy sod, or it may be built in the center of a large grass tuft, in which case it may be elevated a few inches above the surrounding floor. However, so closely hidden is it that considerable search is required to discover the dainty abode.
>
> The nest is made entirely of short grass straws that are not interwoven, and the structure is therefore so fragile that it will scarcely retain its form when removed. The lining may be entirely of fine, thread-like grass shreds, or there may be admixed therewith considerable coarse dog hair. If the latter is used, each hair is laid in separately, and none of the wool-like tufts of the dog's under

coat is employed. The measurements of five nests are: height, 2.00 to 3.50; outside diameter, 3.00 to 4.00; inside diameter, 1.75 to 2.00; and inside depth, 1.50 to 1.75 inches.

H. D. Minot (1880) thus describes a Colorado nest: "The nest was sunken in the ground, on the eastern slope or border of the swamp, at the end of a partly natural archway of long dry grass, opening to the southward, beneath the low, spreading branch of a willow. It is composed of loose shreds, with a neat lining of fine stalks and a few hairs, and with a hollow two inches wide and scarcely half as deep."

Dr. Joseph Grinnell (1909) writes: "A nest of the Alaska pileolated warbler was found by Stephens on the 7th of June near Hasselborg Lake, Admiralty Island. It was in the thick moss growing among the roots of an uprooted tree in a creek bottom. The nest was about five feet from the ground and occupied a niche in the mass of moss which overhung and hid it. The nest consists externally of moss, weathered leaves, and bark strips; internally of deer hair."

Eggs.—All of the 5 nests found by Brandt in Alaska contained 6 eggs each, but farther south the numbers run from 3 to 5, four being the commonest number. The eggs are apparently indistinguishable from those of Wilson's warbler. Dr. Brandt (1943) describes his eggs as follows: "The spots are irregular in shape, angular, and range in size from the finest pepperings to small dots. These are often confluent at the larger end, forming a broad zone or wreath. A few weak markings are scattered towards the small end which is almost unmarked. The markings are of two types: the richer one which is more frequent is of red colors, ranging from brick red to Indian red, with the weaker underlying markings vinaceous lavender. The latter are inconspicuous and often just peer out from beneath the bolder overlying spots." The measurements of 40 eggs average 15.8 by 12.2 millimeters; the eggs showing the extremes measure **17.2** by 12.6, 16.0 by **13.1, 14.7** by 12.2, and 15.2 by **10.7** millimeters.

Plumages.—The molts and plumages of the two western races correspond to those of the eastern race and their food is probably similar; in fact, the three do not differ materially in any of their habits, except as these are affected by their environment.

Behavior.—Mrs. Bailey (1902) writes attractively:

> Seen in migration when the dainty pileolated warbler has plenty of leisure, his airy ways are peculiarly charming. He usually hunts in low bushes, and as he suddenly appears through a chink in the dull chaparral wall the intense brilliant yellow of the little beauty set off by his shining jet black crown gives you a thrill of surprise and delight.
>
> He is winningly trustful and will come close to you and with wings hanging turn his head and look up to you from under his jaunty cap, then whip along with a jerk of his tail. As he goes he stops to run up a twig, leans down to peck under a leaf, flutters under a spray like a hummingbird, and then flies off singing his happy song.

Fall.—This warbler seems to be more abundant, or more conspicuous, on the fall migration east of the Rocky Mountains, where it is often the commonest of all the wood warblers, even as far east as western Nebraska.

Winter.—Of its winter haunts in Mexico, Dr. Beebe (1905) writes:

> The Pileolated Warbler and the Western Gnatcatcher were two small friends which we first met at the edge of the *barranca.* They were cheerful little bodies. forever busy searching leaves and twigs and flowers for tiny insects. Perhaps to this unflagging activity was due the fact that they seemed able to find a substantial living in all sorts and conditions of places. The Pileolated Warbler—so like our Wilson Black-cap, but of brighter yellow—never became common, and yet in every list of birds we made, whether of upland, marsh, cactus desert, *barranca,* or tropical jungle, he was sure to have a place. He was not particular as to his winter home, but found everywhere enough to keep his black-crowned little head busy picking and picking, interpolating a sharp *chip!* now and then, between mouthfuls.

In El Salvador, according to Dickey and van Rossem (1938), "the northern pileolated warbler was found to be a rather common winter visitor between the elevations of 3,500 and 8,500 feet. * * * In its winter home this warbler is chiefly an inhabitant of low growth beneath the forest. Coffee groves are particularly favored in the lower elevations. On Los Esesmiles many were noted in the cloud forest, but there were even more in the arid associations such as oak scrub, bracken beneath the pines, and blackberry tangles along small watercourses."

WILSONIA PUSILLA CHRYSEOLA Ridgway

GOLDEN PILEOLATED WARBLER

PLATES 77, 78

HABITS

This brilliantly golden race of the pileolated warbler is confined in the breeding season to the Pacific coast district, from southern British Columbia to southern California, mainly west of the mountain ranges. Ridgway (1902) describes it as similar to Wilson's warbler, "but slightly smaller and much more brightly colored; olive-green of upper parts much more yellowish, almost olive-yellow in extreme examples; yellow of forehead and superciliary region (especially the former) inclining more or less to orange; yellow of under parts purer, more intense."

Samuel F. Rathbun tells me that in western Washington this is "probably the most common of all the warblers and occurs all through the region, from the foothills of the Cascades to the Pacific Ocean."

In the Lassen Peak region of California, according to Grinnell, Dixon, and Linsdale (1930), "this race of pileolated warbler in summer was limited closely to alder and willow thickets bordering ponds, along streams and in and around the edges of moist meadows. These two plants, alder and willow, appeared to furnish the chief factors favoring the initial choice of this habitat, rather than any of the plants associated with them." Such haunts seem to be favored by the species in other parts of its western range.

Spring.—Rathbun tells me that it arrives in western Washington about the first of May. "It differs in some ways from the rest of the warblers: there is no straggling in their arrival; a goodly number come all at once, followed by the regular run of the birds until all have settled down. In the Olympic region, at least, they stick quite close to the tidewater. Sometimes one can stand on the beach facing the ocean and hear the warbler's song directly behind in the woods; this is one of the very few birds of which this can be said."

Nesting.—Rathbun describes in his notes two nests found near Seattle. One was located about a foot above the ground "in a salal shrub that grew by the side of an old path through the rather dense forest, with a quite heavy undergrowth. The nest consisted, outwardly, entirely of dry, dead leaves, next to which were finer and softer ones of the same character and a little shredded inner bark of a cedar, the lining being fine rootlets and a few horsehairs." The other was "built quite close to the ground on a slight elevation in a mass of dead bracken, being so well concealed that it was found only by flushing the female. It was composed outwardly of dead leaves and decayed weed stalks with a little green moss interwoven, this forming a base on which rested the main part of the nest, consisting of fine, dry weed stalks and shredded strips of the soft inner bark of a cedar, next being very soft, dry leaves, with a lining of fine, dry grasses. The whole structure was beautiful, the material being well interwoven and the construction neat. The outside height was 4 inches, outside diameter 6, inside diameter 2, and inside depth 1¾ inches. The location was well within a growth of young firs, widely scattered so that rather open spaces existed, overgrown with bracken."

James B. Dixon tells me that he found the golden pileolated warbler nesting in Mono County, Calif., at elevations betwen 7,000 and 9,200 feet. And in the Yosemite region, Grinnell and Storer (1924) found a nest that "was in a depression in an earth bank at the base of two azalea stems. It was overhung by these stems and also by a mat of dead brakes, which concealed the eggs from view above. The foundation of the nest was of loosely laid dead leaves, and this graded into the rest of the structure, which was composed of leaves and grass blades. The fine lining was chiefly of deer hair. The structure measured about 3½ inches in diameter outside, and the cavity was 2 inches across and 1¼ inches deep."

J. Stuart Rowley writes to me: "The nests which I have found were all well-made, deep-cupped affairs and were all placed on the ground, either at the base of a clump of skunk cabbage or of a small sapling or shrub."

Eggs.—From 3 to 5 eggs, most often 4, make up the set for the golden pileolated warbler. These are, apparently, indistinguishable from those of other races of the species. The measurements of 40 eggs average 16.2 by 12.4 millimeters; the eggs showing the four extremes measure **17.0** by **13.0**, and **15.0** by **11.9** millimeters.

Young.—Mrs. Amelia S. Allen says in her notes: "I flushed a female from her nest about a foot from the ground in dense bracken. I sat down 6 feet from the nest and she returned almost immediately and regurgitated food, then brooded the three young that had been hatched recently. Then she spent 4 minutes hunting for food, returned, fed the young, and brooded 8 minutes." A few days later torrential rains fell for 4 days, after which she found "a water-soaked nest containing five naked young that had been drowned."

Mrs. Wheelock (1904) says:

> The first brood is usually hatched early in May, and is fed by regurgitation by both parents until four or five days old, when the usual food of small insects and little green worms is given to them in the fresh state. As soon as their nursery days are over, the male takes entire charge of the nestlings, feeding them for ten days or two weeks longer.
>
> For the second brood a locality slightly higher up the mountain may be chosen, but oftener the little mother builds her second nest within a hundred yards of the first, commencing it alone, while the male is still occupied with the first series. Incubation lasts twelve days, and is, I think, attended to solely by the female, although the male is frequently at the nest both to feed her and to watch over—but not brood—the eggs.

Food.—Prof. Beal (1907) examined 52 stomachs of the golden pileolated warbler, and says:

> Animal matter amounts to over 93 percent, vegetable to less than 7 percent. Of the former, the larger item is Hemiptera, which aggregates over 35 percent. The black olive scale was found in four stomachs, but leaf-hoppers make up the bulk of this portion of the food. Hymenoptera stand next in importance, with 31 percent, made up of both wasps and ants. Flies are eaten to the extent of 11 percent, and in connection with the Hymenoptera proves what observations of its habits indicate, that this bird gets much of its food when on the wing. A good many of the insects were the tipulids, or crane-flies. Beetles of half a dozen different families were eaten to the extent of about 9 percent. They were mostly leaf-beetles (Chrysomelidae), with a few weevils and one or two others. No coccinellids were found. Somewhat less than 5 percent of the food consists of caterpillars. They do not appear to be favorite food, for they are eaten very irregularly. Spiders also are taken only sparingly, and form but little more than 1 percent of the total food.
>
> The vegetable food, less than 7 percent of the total, is made up almost entirely of fruit pulp, and was eaten in the months of September and October.

Behavior.—Grinnell and Storer (1924) write:

> Pileolated Warblers do most of their foraging within 6 feet of the ground and practically never ascend far into trees even to sing. They keep within the cover of the lower stratum of foliage and are therefore only to be caught sight of momentarily. The birds are noted for their habit of darting out after flying insects; indeed one book name of the eastern relative of the pileolated is "black-capped fly-catching warbler." Of all our other warblers only the Tolmie is likely to be found in the same cover inhabited by the Pileolated Warbler. The Tolmie often forages out into the drier chaparral, whereas the present species adheres closely to damp situations, either over boggy ground or else within a few yards of a stream. In favorable country, pairs of Pileolated Warblers may occur as frequently as eight or even more to a linear mile.

Voice.—On this subject Grinnell and Storer (1924) say:

> The song of the Pileolated Warbler is far less shrill than that of the Yellow Warbler and is less clear and more mechanical than that of several other warblers. The syllables are given all on about the same pitch and about as rapidly as a person can pronounce them, but with the intervals shortening and the emphasis decreasing toward the end of the series; *tshup, tshup, tshup-tshup-tshup-tshup.* The call note is not nearly so sharp as that of other warblers, but, on occasion, appeals to one as surprisingly loud for the size of the bird. It has an unmistakable quality of its own. Singing is done largely within the cover of the shrubbery; in other words this species does not, as do so many brush dwellers, seek out prominent song perches.

Mrs. Allen writes to me: "The song of this warbler is a series of rather sharp staccato notes without much change of pitch. It is not a trill, but rather a rapid series of *chips.* The call note is easily recognized because it is not a *chip*, but a thin wiry *chee-ee*, with some of the quality of the call note of the western winter wren."

Ralph Hoffmann (1927) says: "Beginners find it difficult to distinguish the song of the Pileolated from that of the Lutescent, with which it is often associated. The distinction lies in the sharpness and staccato quality of the Pileolated's notes, and the final crescendo. There is of course much individual variation, but the typical song may be written: *chit-chi*, *chit-chi*, *chit-chi*, *chit-chi*, *chit-chi CHIT CHIT CHIT;* the song of the Lutescent is softer, more trilled and generally trails off at the close into weaker notes in a lower pitch. The call note of the Pileolated is diagnositic, a husky *tsik* or *tschek*, suggesting a Yellow-throat's but not so heavy."

Field marks.—This species can be recognized by its black cap, very prominent in the male and usually more or less in evidence in the female; young females, in which the black cap is missing, and juvenals resemble female or young yellowthroats, but the latter are more suffused with brownish, the olive and yellow colors in the former being clearer. It is the only western warbler that is wholly olive above and wholly yellow below, with a black cap and with no white in wings or tail. The golden pileolated warbler can be easily distinguished from the northern by its much brighter colors. The song and the call notes are quite distinctive.

Enemies.—According to Friedmann (1929) this warbler is "a not uncommon victim of the Dwarf Cowbird in southern California."

Fall.—Rathbun (MS.) writes from Seattle: "About the middle of August, the golden warbler will often be seen about the city, this being an indication of the fall migration; individuals continue to be noted until about the middle of September. At this time the only note given is a harsh squeak, and the males are very beautiful in their bright, fresh plumage. They will generally be found in the company of the California yellow warbler, one or two of the golden with a number of the yellow warbler."

The fall migration through California, in company with other warblers and vireos, occurs mainly in September. Ralph Hoffmann (1927) says: "the Pileolated Warbler is one of the commonest birds in migration; at times every oak tree or tangle of low bushes seems alive with their bright and active forms."

WILSONIA CANADENSIS (Linnaeus)

CANADA WARBLER

PLATES 78–80

HABITS

In spite of its name, this pretty, necklaced warbler is not confined to Canada, but finds congenial haunts in many of the cooler spots in the Northern States and at the higher altitudes in the Alleghenies as far south as northern Georgia. Gerald Thayer wrote to Dr. Chapman (1907): "It is a bird of rich deciduous undergrowth in the deep, damp forest,—a ranger between the bush-tops and low tree-branches and the ground. It avoids purely coniferous woods, and so is almost wholly wanting from the closely-spruce-clad northern slopes of Mt. Monadnock [New Hampshire], though abundant in the deep mixed timber all about its northern base. On the *eastern* slopes of the mountain, where the forest is more largely deciduous, the Canada is fairly common almost up to the rocky backbone ridge, at heights of from 2,300 to 2,700 or so feet."

In southeastern Massachusetts, where I live, the Canada warbler breeds regularly, but not abundantly, in the cool, damp, heavy woods of mixed growth, mainly around the borders of the extensive cedar swamps, but also in mature forests where large trees furnish cool shade and where rocky ravines are watered with spring-fed streams.

Rev. J. J. Murray tells me that this is the most common warbler on the higher mountains of West Virginia, abundant above 3,000 feet. Prof. Maurice Brooks (1936) says that it "has found an apparently satisfactory home in the deciduous second growth. This species shares with the Magnolia the claim to being the most abundant northern warbler in West Virginia. There is not a mountain area where it may not be found." Elsewhere, he says (1940) : "A favorite haunt is a ravine with dense hemlock overstory and an understory of tangled rhododendron."

In northwestern North Carolina, Thomas D. Burleigh (1941) found it on Mount Mitchell, "a plentiful breeding bird in the cut-over area to an altitude of approximately 6,300 feet, appearing early in May and lingering until the first of September. Not known to nest in the fir and spruce woods at the top of the mountain until the year 1934 when two pairs were found there May 23." He had previously (1925) found it breeding in northeastern Georgia on the north slope of Brasstown Bald above an elevation of 4,000 feet. He felt sure "that at least ten pair must have nested there among the moss-covered boulders and tangled rhododendron thickets."

Spring.—From its winter haunts in South America the Canada warbler migrates through the eastern United States in May, covering a period of 3 or 4 weeks in passage. Prof. Cooke (1904) writes: "The great bulk of the species passes along the Atlantic coast and westward to and including the valley of the Ohio. In the interior the bird is a rare migrant from eastern Texas, eastern Kansas, eastern Nebraska, through the valley of the Red River of the North to Manitoba. Accidental occurrences are reported from central Texas, southern New Mexico, and eastern Colorado."

On the spring migration, we generally see the Canada warbler in the lower stories of the swampy woods, or in the denser underbrush, much such places as are frequented by Wilson's warblers. Referring to Ohio, Milton B. Trautman (1940) says: "In spring the species was found in the greatest numbers in the profuse shrub layer of the larger upland and lowland remnant forests. This lovely warbler had a decided preference for the spicebushes (*Benzoin aestivale*) of the swamp forest, and it fed and sang its pleasing song among these newly leaved flowering shrubs."

Nesting.—The Canada warbler builds its nest on or near the ground, often in a mossy hummock, on a moss-covered log or stump, or in a cavity in a bank or the upturned roots of a fallen tree. Robie W. Tufts' notes mention a Nova Scotia nest that was "built among the roots of an upturned tree over a pool of water, in thick, swampy land in coniferous woods." F. H. Kennard records in his notes two nests, found near Lancaster, N. H., that were placed on the sides of moss-covered stumps. In Owen Durfee's journal I find the descriptions of five nests of this warbler, found in the same locality; these were all well hidden in sphagnum moss, or green tree moss, on hummocks, old stumps or fallen logs; two were in a wet swamp and less than a foot above water. The nests were well inside the concealing moss with an entrance about 2 inches wide; one nest measured 4½ inches in outside diameter, 2½ in inside diameter, and 1½ inches in inside depth.

Miss Cordelia J. Stanwood (MS.) describes a nest she found near Ellsworth, Maine, placed in a rather open situation on the ground between a moss-covered stump and the roots of a gray birch. "The outside was composed of leaves—poplar, dwarf cornel and gray birch—with the addition of the inner bark fibre of such young dead trees as poplar, soft maple, and willow, and also a few white pine needles, several decayed fern stipes, and a number of skeletonized leaves. The lining consisted of minute threads of inner bark fibre and a few black horsehairs. Aside from the large, dry leaves on the outside, the stuff of which the structure was composed was fine, even minute, in texture."

Of the nesting of the Canada warbler in western Pennsylvania, W. E. Clyde Todd (1940) mentions situations such as those described above and adds: "R. B. Simpson, who has found many nests in Warren, reports that they are also placed under the projecting banks of streams and among the ferns and moss on the sides of large rocks and ledges. One nest referred to by Burleigh was built in a mass of dry leaves at the base of a huckleberry bush; the brim was flush with the ground. Wherever located, the nest is a more or less bulky, formless structure; it is composed of dry (often skeletonized) leaves, shreds of bark, dry grass, and weed stalks, with a lining of finer vegetable fibers, among which the black rootlets of the maidenhair fern (*Adiantum*) are a conspicuous element."

T. E. McMullen has sent me the data for eight sets of eggs, found in the Pocono Mountains, Pa.; two of these were in upturned roots, two in rotten stumps, one 3 feet up on the side of a 10-foot creek bank, and the others were on the ground, one of which was among rhododendrons.

I found my first and only nest of the Canada warbler in Bridgewater, Mass., on June 9, 1924. While walking through some mixed moist woods, mostly white pines with a few oaks and other deciduous trees, near a swampy place, I flushed the warbler from its nest almost under foot; it was in plain sight at the foot of a clump of brakes (*Pteridium aquilinum*); the nest contained three fresh eggs; two days later, I photographed the bird on its nest. The nest, now before me, is rather bulky and loosely made externally of dry and skeletonized leaves, coarse strips of weeds and inner bark, stems and fronds of ferns and weed tops; it is lined with very fine plant fibers, fine rootlets, and hair. The outside diameter is about 4 by 5 inches, the height about 2½, the inside diameter 2¼ by 2½, and the inside depth 1¾ inches.

Eggs.—From 3 to 5 eggs, usually 4, constitute the set for the Canada warbler. They are ovate, some tending toward short ovate, and are slightly glossy. The white, or creamy white, ground color is speckled, spotted and sometimes blotched with "chestnut," "bay," or "chestnut-brown," with undertones of "light Quaker drab," or "light purplish gray." On many, the markings are confined to speckles which may be scattered all over the eggs, although they are generally concentrated at the large end, where frequently they form a distinct wreath. Occasionally eggs may have spots of "Hay's brown" and black, instead of the usual red-browns. One set of eggs which I collected is boldly marked with blotches of rich red-browns instead of the usual smaller spots. The measurements of 50 eggs average 17.2 by 13.1 millimeters; the eggs showing the four extremes measure 18.4 by 12.6, 18.0 by 14.0, 16.1 by 12.9, and 17.1 by 12.2 millimeters (Harris).

Young.—The period of incubation for the Canada warbler does not seem to have been determined, nor do we know just how long the young remain in the nest. Data on the development and growth of the young seem to be lacking. The female probably does all, or most, of the incubating and the brooding. Both parents feed the young and remove the excretal sacs.

Miss Stanwood placed a blind within a few feet of a nest and watched the birds feed the young. Her notes indicate that they are fed at frequent intervals, sometimes as often as once a minute, but more often at intervals of from 3 to 6 minutes; occasionally an interval of 15 or 20 minutes may elapse between feedings. She saw the male feed several nestlings with a large beakful of yellow grubs that had probably been found in rotten wood. He was seen to catch mosquitoes on the wing and feed them to small young by regurgitation. Green and gray caterpillars and brown measuring worms were fed to the young, and once a large gray moth. If the nest was left long unguarded, it was overrun with insects, but the female usually cleared the nest of such vermin by burrowing under the young and removing them.

Plumages.—Dr. Dwight (1900) calls the natal down of the Canada warbler sepia-brown, and describes the juvenal plumage, in which the sexes are alike, as "above sepia and, when older and faded, hair-brown. Wings and tail dull olive-brown, faintly edged with dull olive-green; wing coverts paler and indistinctly edged with buff. Below, primose-yellow washed with pale wood-brown on the throat and sides. * * * Practically indistinguishable from *S. pusilla* except by duller wing edgings."

The first winter plumage is acquired by a partial postjuvenal molt, beginning early in July, which involves the contour plumage and the wing coverts, but not the rest of the wings or the tail. The sexes are recognizable in this plumage. Dr. Dwight describes the young male as "above, cinereous gray, browner on the back, the crown yellow-tinged and sometimes flecked with black; wing coverts uniform with the back. Below, including supraloral line lemon-yellow, the orbital ring paler, a narrow 'necklace' of small black spots on the jugulum the black extending to the auriculars and lores, slightly veiled by overlapping yellow edges; the crissum dull white." The first winter female plumage "is a little paler than that of the male without black on the crown which is brownish in contrast to the back and the 'necklace' consists of obscure grayish lines."

The first nuptial plumage is acquired mainly by wear, but there is a limited prenuptial molt about the head, chin, and throat. Young birds are now like the adults, except for the worn wings and tail, which have been carried over from the juvenal plumage. Adults have a complete postnuptial molt in July. The adult winter plumage of the male is "quite different from first winter dress, the black 'necklace' being of heavy streaks and the black area on the lores and crown larger; black feathers with broad grayish edgings are assumed on the crown, and the wing edgings are apt to be grayer and bluish instead of greenish." In the female, "the adult winter plumage differs slightly it any from the first winter; it has a bluer gray tint on the back and the crown is yellow-tinged rather than brown."

The adult nuptial plumage in both sexes is acquired mainly by wear, with possibly some new growth. The female is always duller in coloration than the male, but she usually shows some traces of the "necklace."

Food.—Ora W. Knight (1908) says of the food of the Canada warbler: "They eat moths, flies, beetles, grubs, caterpillars of the smooth, hairless type such as canker worms, the eggs of insects, spiders, mosquitoes and similar insects." Prof. Aughey (1878) found five locusts and 29 other insects in a stomach examined in Nebraska. The items mentioned above as the food of the young are doubtless also included in the food of the adults. Of three specimens examined by F. H. King (1883) in Wisconsin, "two had eaten flies; one, a hymenopterous insect; one, beetles; and one larvae." Although the Canada warbler obtains most of its food on the branches and foliage of trees, as well as on the ground, it feeds largely on the wing, catching its insect prey in the air. It is one of the most expert of the warblers in this pursuit, hence it was formerly called the Canada flycatching warbler, or Canada flycatcher.

Behavior.—Gerald Thayer wrote to Dr. Chapman (1907): "The Canadian is a sprightly, wide-awake, fly-snapping Warbler, vivid in movement and in song; clearly marked and brightly colored. In actions it is like the Wilson's, a sort of mongrel between a *Dendroica*, an American Redstart, and a true Flycatcher. It darts after flying insects like one of the Tyrannidae, and its bill may sometimes be heard to 'click' when it seizes something; it has much of the Redstart's insistent nervousness of motion, but it is a less airy 'flitter'; and, finally, it glides and gleans among leaves and twigs like a true gleaning Warbler."

But, with all its nervous activity, it is not particularly shy nor timid; I had no difficulty in photographing it on its nest, and Miss Stanwood observed at short range a pair feeding their young.

Voice.—Aretas A. Saunders has contributed the following account: "The song of the Canada warbler is a series of rather rapid notes and 2-note phrases, varying greatly and most irregularly in pitch and time. There seems to be no general rule about the form of the song, except that two notes in succession are rarely on the same pitch. The quality of the notes is fairly musical and rather similar to that of the yellowthroat. Not only is the song variable in different individuals, but the same bird often varies it greatly. I have records of 7 songs by one individual, and 11 by another, all more or less distinct.

"The number of notes in the song varies from 5 to 15, averaging about 10. The length of song varies from 1 to 2⅗ seconds. The pitch ranges from E‴ to F⁗, and single songs have ranges from one and one half to three and one half tones, averaging two and one half. These are results from 47 records of the song.

"The length of individual notes varies, as well as the pitch, short and long notes being mixed irregularly. Occasional notes are accented. Explosive consonant sounds are fairly clear. No one rendition will fit more than one song, but one may give a general idea of the songs. *Tsip chitawee tita wee'ti tipa tupa tee* is an example of one written in the field as I listened to the bird. I have heard a flight song from this bird; it is like the regular song but more prolonged.

"The Canada warbler sings on the breeding grounds till the middle of July. Records of 14 summers in Allegany State Park give an average date of July 16; the earliest are July 11 (1929 and 1939) and the latest is July 31 (1937). The song is resumed after a rather short interval, in late July or August. This bird sings more frequently after the molt than any other warbler I know of. The song is about as common in the first half of August as in early July."

The animated song of the Canada warbler is regularly heard on migration. Many years ago, I recorded it in Taunton in May as a striking, variegated warble, rapidly uttered and fairly well indicated by such syllables as *ker*, *chicharew*, *chichew*, *chicherew*, *chew*, or *chick-*

arew, chicarie, cherwee. Again, on its breeding grounds in Maine, I wrote it as *cher, whit, whit, whe'o,* or *cher, whit, whit, whe'o, whe'o,* with many variations, sometimes a continuous warble, but always rich in tone, strongly accented, loud and striking.

A. D. Du Bois writes it in his notes as *te wichi tichy—te wich chu,* or *te wichi tichi—te wichi wee,* or *te wich e wee.* Francis H. Allen (MS.) writes: "The characteristic song of this warbler is of a warbling character but ends with an emphatic *wip.* I have been in the habit of writing it (unrealistically) as *te-widdle-te-widdle, te-widdle-te-wip'.* I once heard one reverse the order of the two parts, singing repeatedly *te-widdle-te-wip', te-widdle-te-widdle.* On June 2, 1929, in Newton, Mass., I heard one give a continuous performance of singing, one song following another immediately, the whole interspersed with *chips* and short trills. It was restless and flew ahead of me as I walked, finally perching on a small dead limb near the top of a small tree, where it constantly shifted its position as it sang, turning its head this way and that, and frequently facing about. It seemed to be in a frenzy of excitement."

Field marks.—The adult Canada warbler can always be recognized by the plain gray of the upper parts, without any white markings in wings or tail, by its yellow eye ring, and especially, by the pretty necklace of black spots on the yellow breast. The female is marked like the male, but her colors are somewhat duller. The young bird, in juvenal plumage, is much like the young Wilson's warbler.

Fall.—The general trend of the fall migration from eastern Canada and New England, is southwestward, and more directly southward from central Canada. Professor Cooke (1904) says:

> The birds from the northeastern section of the United States appear to follow the general trend of the mountains to the Gulf Coast, being found in the fall apparently not east of Mississippi. Thence they cross the Gulf of Mexico to southern Mexico and Guatemala, reaching the Pacific coast at Tehuantepec. They probably then turn southeast and follow the mountains through Costa Rica and Panama to their principal winter home in Ecuador and Peru."

It is doubtful if all regularly migrate across the Gulf; probably some of them migrate through Texas, for Dr. W. P. Taylor tells me that two were collected in Polk County, on September 7, 1937; they were in cut-over longleaf pine timber; one was in an association of blue-gray gnatcatchers, chickadees, titmice and one Carolina wren; the other was alone in a sweet gum tree near a cornfield. Again, two days later, "this warbler was found to be quite numerous here in the river bottom. Seemed to show little preference for the tall trees over the shrubs, being seen equally often in both. I flushed several off the ground."

Dr. Alexander F. Skutch writes to me: "The Canada warbler is known in Central America only as a rather rare transient, journeying between its breeding ground in the north and its winter home in South America. It has been seen far more often in the fall than in the spring; and in Costa Rica, although there are a number of fall records, it has apparently never been noted in the spring. On its southward migration through Central America it spreads over both coasts as well as the central highlands up to 6,500 feet or more. The extreme dates of its fall passage are September 8 to October 7 in Guatemala, and to October 20 in Costa Rica. It appears to travel singly rather than in flocks—at least, while resting and feeding it is almost always found alone; and I have only rarely seen two together. At this time it is found either in the woodland or among scattered trees."

Dickey and van Rossem (1938) write: "The Canada warbler is by no means a common species in El Salvador, even during the height of the migration. All those that were noted were either in forest undergrowth or in the lower levels of foliage. Not one individual was detected during the spring mingrations—a circumstance which indicates that El Salvador is somewhat off the main migration route of this species."

Winter.—Professor Cooke (1904) gives the following account of this warbler's winter haunts:

> The winter home of the Canadian warbler lies a long distance from Canada. The species is found in greatest abundance in Peru, especially in the northern portion, and in the neighboring regions of southern Ecuador. In these sections it is found through the winter in flocks, which wander over the country on both the eastern and western slopes of the Andes. The extremes of the normal altitudes attained by the bird are 3,700 and 7,000 feet. Most of the records of its occurrence were made at an elevation of 4,000 to 5,000 feet. One specimen was secured at Quito, Ecuador, at 9,500 feet altitude. The extreme southeastern point at which it has been recorded is in the mountains east of Lima, where Jelski took a male and two females on the eastern slope of the Andes at over 10,000 feet elevation. These individuals were 5,700 miles distant from Labrador by the principal route of migration followed by the species.

DISTRIBUTION

Range.—South central and southeastern Canada, eastern United States south to northwestern South America.

Breeding range.—The Canada warbler breeds **north** to central eastern Saskatchewan (Hudson Bay Junction and probably Cumberland House); central Manitoba (probably the head of Lake Winnipegosis); central western and northwestern Ontario (Kenora and Moose Factory); central Quebec (Mistassini Post, Inlet, Matamek, and Anticosti Island); and Newfoundland. **East** to Newfoundland; Massachusetts (Bristol County); Rhode Island (Noyes Beach); rarely

Connecticut (North Cornwall, Hartford, and Hadlyme); southeastern New York (Putnam County); northern New Jersey; central Pennsylvania (State College, Pottsville, and Mauch Chunk); western Maryland (Dans Mountain); western Virginia (Roanoke and Blue Ridge Mountains); western North Carolina (Highlands, Black Mountain, and Boone); and northeastern Georgia (Brasstown Bald). **South** to northeastern Georgia (Brasstown Bald) and eastern Tennessee (Cosby Knob). **West** to eastern Tennessee (Cosby Knob); eastern Kentucky (Black Mountain); eastern West Virginia (Terra Alta, Watoga, and White Sulphur Springs); northeastern Ohio (Pymatuning Swamp); southern Ontario (Listowel, Elora, and Hallowell); northern Michigan (Blaney Park, Weketonsing, and Bois Blanc Island); northern Wisconsin (Ladysmith, Unity, and Kelley Brook); central Minnesota (Cass Lake, and Mille Lacs); southern Manitoba (Aweme and Portage la Prairie); and central eastern Saskatchewan (Cumberland House).

Winter range.—The Canada warbler winters in western Colombia (Alto Bonito, Río Frío, and San Antonio) south through Ecuador to central Perú (Lima region and La Merced).

The species is casual in Colorado (Clear Creek and Parker Lake); and is accidental in Alaska (Forrester Island); California (Santa Barbara); and Greenland.

Migration.—Late dates of spring departure from the winter home are: Peru—Tambillo, March 28. Ecuador—San José, April 2. Colombia—San Agustín, April 10. Panamá—Gatún, April 28. Guatemala—above Tecpán, April 29. Florida—Wakulla County, May 5.

Early dates of spring arrival are: Florida—Princeton, March 17. Alabama—Birmingham, April 24. Georgia—Milledgeville region, April 7; Atlanta, April 23. South Carolina—Spartanburg, April 30. North Carolina—Highlands, April 29. Virginia—Charlottesville, April 30 (average, May 3); Rockbridge County, May 6. West Virginia—French Creek, April 27 (average of 16 years, May 1). District of Columbia—Washington, May 2 (average of 38 years, May 8). Maryland—Baltimore, April 26. Pennsylvania—Brookville, May 2; Beaver, May 3 (average, May 7). New Jersey—Morristown, May 2; Union County, May 7 (average, May 11). New York—Rochester, May 1; Ballston Spa and Westchester County, May 2. Connecticut—Portland, May 1. Rhode Island—Cranston, May 3. Massachusetts—Nahant, May 1. Vermont—Woodstock, May 10. New Hampshire—Charlestown, May 6. Maine—Brunswick, April 24; Bangor, April 25. Quebec—Montreal, May 4. New Brunswick—Bathurst, May 12. Louisiana—Monroe, April 27. Mississippi—Tishomingo County, May 3. Arkansas—Delight, April 25. Tennessee—Memphis, April 24; Athens, April 27 (average of 7 years, April 30). Kentucky—Bowling Green, April 28. Missouri—New Madrid County, April 10; St. Louis, April 28. Illinois—Chicago region, April 30 (average, May 9). Indiana—Wheatland, April 18; Holland, April 22. Ohio—Oberlin, April 28; central Ohio, May 2 (average, May 7). Michigan—Petersburg and Ann Arbor, May 1. Ontario—Walton and Hamilton, May 3; Ottawa, May 15 (average of 14 years, May 21). Iowa—La Porte City, May 6. Wisconson—Milwaukee and Madison, May 6. Minnesota—Fairmont, May 4 (average of 25 years for southern Minnesota, May 13). Texas—Victoria, April 1. Kansas—Harper, April 24. Nebraska—Greeley, May 3. South Dakota—Sioux Falls, May 18. North Dakota—Wilton, May 11. Manitoba, Aweme, May 18 (average, May 28). Saskatchewan—McLean, May 14. Alberta—Edmonton, May 29.

Late dates of fall departure are: Alberta—Glenevis, August 29. Saskatchewan—Last Mountain Lake, September 3. Manitoba—Winnipeg, September 11; Aweme, September 4 (average, August 28). North Dakota—Jamestown, September 14; Cass County, September 6 (average, September 1). Kansas—Lake Quivira, Johnson County, September 7. Texas—Dallas region, October 17. Minnesota—Hutchinson, September 30. Wisconsin—Milwaukee, October 10. Iowa—Davenport, October 4. Ontario—Ottawa, September 5; Welland County, October 10. Michigan—Detroit, September 30. Ohio—central Ohio, October 2 (average, September 21). Indiana—Richmond, October 9. Illinois—Chicago region, September 22; (average, September 11); Rockford, October 17. Missouri—St. Louis, October 5. Kentucky—Bowling Green and Letcher County, September 25. Tennessee—Elizabethton, October 22. Mississippi—Ariel, October 14. Louisiana—Baton Rouge, October 17. Quebec—Gaspé County, September 25. Maine—Pittsfield and Winthrop, September 12; Cutler, October 31. New Hampshire—Monroe, September 18. Vermont—Wells River, September 21. Massachusetts—Hamilton, October 16. Rhode Island—Watchaug Pond, October 8. New York—New York City, October 29, November 13. New Jersey—Union County, October 2 (average, September 21). Pennsylvania—Pittsburgh, October 3; York, October 7. Maryland—Plummers Island, October 23. District of Columbia—Washington, October 11 (average of 16 years, September 18). West Virginia—Bluefield, September 31. Virginia—Charlottesville, September 28 (average, September 25). South Carolina—Clemson, October 28. Georgia—Atlanta, September 24. Alabama—Birmingham, October 1. Florida—Dade County, October 14. Guatemala—Colomba, Quezaltenango, October 7.

Early dates of fall arrival are: North Dakota—Fargo and Cass County, August 16 (average for Cass County, August 24). Texas—Cove, August 18. Minnesota—Minneapolis, August 13 (average of 9 years for southern Minnesota, August 22). Wisconsin—Racine, August 16. Iowa—Emmetsburg, August 13. Ontario—Toronto, August 5. Michigan—Sault Ste. Marie, July 29. Ohio—Dayton region, August 12 (average for central Ohio, August 27). Indiana—Richmond, August 15. Illinois—Chicago region, August 3 (average, August 19). Missouri—St. Louis, August 15. Tennessee—Lebanon, August 21. Arkansas—Winslow, August 26. Mississippi—Gulfport, August 30. Louisiana—Saint Francisville, August 13. Massachusetts—Northampton and Belmont, August 2. Connecticut—Fairfield, August 11. New York—New York City, August 6. New Jersey—Essex County, August 2; Union County, August 10 (average, August 16). Pennsylvania—Pittsburgh, July 25 and 27. Maryland—Middle River, August 7. District of Columbia—Washington, July 31 (average of 15 years, August 19). West Virginia—Bluefield, August 13. Virginia—Charlottesville, July 24 (average, August 14). North Carolina—Chapel Hill, August 29. Georgia—Atlanta, August 6. Alabama—Leighton, August 18. Mexico—Tamaulipas, Matamoros, August 19. Guatemala—Colomba, Quezaltenango, September 23. El Salvador—Lake Olomega, September 1. Costa Rica—San Miguel de Desamparados, September 14. Panamá—Almirante, September 22. Colombia—Chicoral, October 12. Ecuador—below Oyacachi, August 9. Perú—Huachipa, October 1.

Egg dates.—Maine: 10 records, May 30 to June 21.

New York: 25 records, May 25 to June 26; 15 records, June 1 to 8.

Pennsylvania: 19 records, May 27 to June 25; 12 records, May 30 to June 8 (Harris).

SETOPHAGA RUTICILLA RUTICILLA (Linnaeus)

SOUTHERN AMERICAN REDSTART

PLATES 81–83

HABITS

CONTRIBUTED BY ALFRED OTTO GROSS

The southern redstart is one of the commonest warblers in New England, perhaps second in abundance only to the yellow warbler. It is a resident of our forests, but unlike the ground-inhabiting ovenbird it is strictly an arboreal species and is much more frequently seen. Because of the brilliant, contrasting colors of the male and its extreme vivaciousness it is better known, and to many it has proven to be a favorite warbler. The bright flashes of orange-red which it proudly displays in its frequently spread tail and fluttering wings has suggested to the imaginative Cubans the beautiful name Candelita, the "little torch," which in such unusual numbers brightens the dark shadows of their tropical forests. In the Province of Quebec, the Canadian French know it as "La Fauvette à Queue Rousse," another allusion to the bright red patches in the male's tail. Like many other American birds the name redstart was given it by the earlier settlers who bestowed upon it the name of a familiar Old World form which also has an orange-red tail but is otherwise very different in coloration and belongs to another family.

One of the most pleasant experiences I have had with warblers in the Maine woods, occurred on a bright morning in May when I suddenly came upon three male redstarts. One of them was working along a horizontal birch limb with its wings lowered in characteristic fashion and eagerly scanning every twig in its quest of insects. The other two were whirling about, darting upward, floating downward displaying their gorgeous colors, then snapping up their victims as they dashed again and again through a haze of midges hovering in the sunshine of the clearing. This scene, as it was enacted against a contrasting background of rich green hemlocks and firs, always comes to my mind when I think of redstarts.

The redstart's manner of catching insects, as well as the shape of its bill and the well-formed rictal bristles, suggests the flycatchers; but instead of perching and patiently waiting for his prey to come near, as does a true flycatcher, the redstart is continually in action, dashing here and there after flying insects or perhaps snapping up larva dangling in midair at the end of its long silken fiber.

Spring.—The redstart, which spends the winter in the West Indies and Central and South America, makes its first appearance in spring on the Florida Peninsula and coasts of the other Gulf States during the first week of April. By the middle of the month the vanguard reaches North Carolina, Kentucky, and Missouri. During the last week of April they progress as far as Maryland, Pennsylvania, and Indiana. We may expect the first arrivals in New England, New York, Ohio, Michigan, and Iowa during the first week of May. By the middle of the month they reach Quebec, Ontario, and Manitoba; and before the end of May they arrive at the outposts of their summer range in northern British Columbia.

After the redstarts leave their winter quarters early in April, they cross the Gulf of Mexico, following no particular route, or proceed from the West Indies via Florida. They thus enter the United States on a wide front extending westward a distance of some 2,000 miles to Texas. From this wide area of entry they spread out fanlike, as do members of many other species, until they reach across the widest part of the North American Continent from Newfoundland on the east to British Columbia on the Pacific. The migration from the winter quarters to the extreme northwestern section of its nesting range requires somewhat less than two months.

Milton B. Trautman (1940) from many years of observations at Buckeye Lake, Ohio, finds that the first redstarts arrive there in April. A marked increase in numbers occurs during the first week of May, the period of maximum abundance extending from May 10 to May 20. A marked decrease occurs after May 22, and a few days later virtually all that remain are summer residents. This condition seems to be typical throughout this belt of the redstart's range. At points farther south or north the dates would be correspondingly earlier and later.

Courtship.—The males are the first to appear and can be heard singing at the time of their arrival. The females come a few days or a week later. Although the first redstart arrivals in Maine may be expected early in May, it is several weeks before the bulk of the resident birds are to be found on their breeding grounds. The males exhibit unusual aggressiveness and indulge in a good deal of fighting in defending their chosen territories. Sometimes two males may be seen hovering in flight as they peck viciously at each other and then perhaps dart into cover with their tails spread and their whole being in a quivering belligerent state. Again, the strutting antics of the amorous males may be seen as they display before the females.

Joseph J. Hickey (1940) as a result of a very intensive and thorough study of the redstarts on a 40-acre area in Westchester County, N. Y., gives us an excellent account of their courtship and territorial aspects. The redstart, he says—

> is a highly territorial species. Males advertised their presence by their typical well-known song and by formalized territorial displays that apparently served to define boundaries and reduce fighting. These displays consisted of short, horizontal, semicircular flights made with stiffened wings and out-spread tails. These performances were frequently observed between males, less commonly between females and never between a male and a female where a question solely of territory was involved. Hingston's interpretation of the function of warning coloration in plumages seemed to be particularly applicable in these cases. Low, repeated *quit, quit* notes could be heard when the displays were concluded and the birds returned to their perches. As far as could be observed, the same performances seemed to serve as some part of the male's courtship of the females. On all exciting occasions, of course, both sexes spread their tails like many other wood warblers. Flight songs appeared to be absent. Singing perches, if present, were largely undetected by the observer. One male which took up territory in a blackberry-locust association sang frequently on April 30 and May 8 only one to two feet from the ground. Three males were once watched for an entire morning before females had arrived in the area: one was quite obviously patrolling the boundaries of his territory, the two others seemed to be moving back and forth on an indefinite and irregular axis, which approximated the length of their territories.
>
> A special effort was made in 1937 to learn the number of unmated males. Twenty-four occupied rigidly fixed territories on the study area. Twenty of these birds were definitely mated. Of the remaining four, one held a territory

until at least June 13, another until at least June 19, a third until June 20, and a fourth until June 26. If all four, or even half of these were unmated, the percentage of paired birds would be between 83 and 91. * * * An indeterminate number of unmated wandering males also exist. * * *

A male in the immature plumage spent the entire morning softly singing and gradually working its way along 800 yards at the top of the ridge. This bird was furiously driven off by males and females whenever it passed through their territories. Plumage notes on 48 males on territory showed that only four (8.3 per cent) were in immature plumage. All four were paired and possessed territories of the same size as those of the adult males.

The size of territories was about one acre or less, but in one instance was compressed to about half an acre. Approximately twenty-two pairs (or males) each year occupied the 39.93 acres under investigation. Their boundaries were observed in two cases to break down on June 17, when young were being fed in the nest. Interspecies competition or jealously were seldom in evidence. Redstarts and Ovenbirds were the two most dominant species of the slope and both would sing in the same tree without the slightest evidence of hostility. The former was once seen briefly fighting with a Black and White Warbler.

Nesting.—In Maine the redstart is an inhabitant of the hardwood or mixed deciduous and coniferous woodlands. These may be in low, damp situations but many of them are found in the second growth of trees and brush of our dry sandy plains. Often the nests are found in the thick growth of small trees which border the forest of larger trees, as well as in places where trees have sprung up along the roadsides. Others may be found in alder and willow thickets bordering our streams and ponds. In New York, it nests in low, damp woods; it has been found in mixed woodland with a considerable growth of pine and hemlock; and in the Adirondacks its nesting site is often in places where spruces predominate. In Ohio, Michigan, and other sections of the Middle West it frequents the maple, elm, ash, and pin-oak association of the larger, more mature swamp forests, although sometimes found among similar trees and brush in the larger upland woods. In the far Northwest it shows a decided preference for willow trees and alder thickets.

There is a tendency for the redstart to forsake the seclusion of the woodlands and, like the yellow warbler, to build its nest in trees and shrubbery adjacent to human habitations. It may even use the exterior of a human dwelling for a nesting site. Annie Lyman Sears of Waltham, Mass., reports that a nest was built on a bracket above a Venetian ironwork lantern hanging before the front door of her home The redstart has also taken up its residence in the parks located in the midst of some of our densely populated cities.

The most usual site of the nest of the redstart is an upright, 3- or 4-pronged crotch of a dead or live hardwood sapling, such as a maple, elm, ash, or birch. The majority of the nests range from 4 to 20 feet above the ground with an average height of about 7 feet. However, in many instances the redstart has selected other than typical nesting sites.

J. Claire Wood (1904) reports finding a nest in Wayne County, Mich., that was partly sunken into the ground at the base of a gooseberry bush between two logs, a very unusual situation. Verdi Burtch has sent us a photograph of a redstart's nest, found near Branchport, N. Y., May 31, 1929, that was built in the forks of a bush only a few inches above the ground. Richard C. Harlow reported that he found a nest at Tabusintac, New Brunswick, June 26, 1919, that was 20 inches above the ground; it straddled and was near the tip of the horizontal limb of a spruce standing on the edge of a bog in rather open woods. On June 25, 1927, at Squam Lake, N. H., Arthur C. Bent found a nest 5 feet up in the fork of a dead branch that had fallen and was leaning upright against a striped maple sapling. At Brunswick, Maine, I discovered a nest held by a thick cluster of branches growing upward from the side of the main trunk of a large elm tree more than 2 feet in diameter at the base. This nest was not less than 30 feet from the ground. Nests placed in crotches formed by limbs branching from the main trunk of large trees are not rare. J. Claire Wood (1904) also reports an extreme case of a redstart's nest built 70 feet above the ground in a large oak tree.

The redstart may also choose a small shrub or bush for its nesting place. A. C. Bent found a nest with three eggs, at Squam Lake, N. H., built in a small mountain laurel among a large clump growing in deep woods. The nest was not over 2 feet above the ground, a situation often selected by the black-throated blue warbler.

In June 1942 a pair of redstarts built their nest in a lilac shrub next to a house on Boody Street, Brunswick, Maine. It was saddled in a cluster of branches about 5 feet above the ground and was only a foot from a front window. Pedestrians frequently passing by on a walk only a few feet distant did not seem to disturb the birds in the least, and the birds even allowed me to take motion pictures of them as I stood only 4 feet away, completely exposed to view. During the same month another pair occupied a mockorange bush growing in the yard of a home only a short distance from this nest. Their nest rested on a horizontal branch about an inch in diameter and was securely anchored by three small upright branches. M. B. Trautman (1940) found six nests of the redstart in the Buckeye Lake region, Ohio, all in grapevine tangles 10 to 20 feet above the ground. J. Claire Wood (1904) describes an interesting nest in a grapevine in Wayne County, Mich., as follows: "This vine reached downward about ten feet from the first limb of a large oak tree and thence upward to within a foot of the starting point, forming a swing, and at the bottom of the loop the nest was placed. It was a windy day and the nest swung over a space of five feet, but madam clung to her treasures perfectly unconcerned."

Another curious departure from the usual nesting habits of the redstart is its use of old or deserted new nests of other species such as the vireos. On June 5, 1898, in Yates County, N. Y., Verdi Burtch (1898) found a red-eyed vireo's nest which had been newly lined with red bark fibers that the redstart usually uses to line its nests in that locality. The nest contained three fresh eggs of the redstart. Others have come to my attention: Three in which red-eyed vireo's nests were used, one in which a yellow-throated vireo's nest was used, and another in which a nest started by a yellow warbler was used. Since these instances were in widely separated places, it indicates the practice is not isolated or merely local. The nest is built entirely by the female, which exhibits more than ordinary architectural ability. It is a firm, compact structure composed of various plant and bark fibers, small rootlets, and flexible grass stems. The outside walls are covered with plant fibers, ornamented with small lichens, bits of birch bark, bud scales, seed pods, and vegetable down firmly bound in with a liberal use of spider web. The interior is lined with fine grasses, weed and bark fibers, and often with the hair of horse or deer.

Feathers of various kinds are frequently used, apparently as an added decoration. These may be ordinary small chicken feathers, but sometimes those of highly colored birds such as the tanager or indigo bunting are chosen. Ernest H. Short (1893) gives an account of a redstart's nest made up almost entirely of the feathers of a wood thrush that had been killed by an owl near the nesting site.

Each nesting season I put out masses of cotton and tow for various birds to use as nesting material. A redstart which built its nest in a tall, slender maple nearby not only used some of the long delicate fibers of tow but studded the whole structure of the nest with small tufts of cotton, giving it a most unusual appearance, not unlike many similarly decorated yellow warbler's nests I have seen. The nest of the redstart somewhat resembles that of the yellow warbler but it is a neater structure with thinner walls, especially at the rim. It is higher than wide and in this respect differs from the goldfinch's nest, which is wider than high.

The average dimensions of a series of nests are as follows: outside diameter 2⅞ inches, inside diameter 1½ inches; outside depth 3 inches, and inside depth of the cup 1½ inches. The chief departure from these dimensions are of nests that are built in very narrow crotches where the upright supporting branches are close together at their point of origin. In such cases the birds continue to build until a sufficient height is reached to give a satisfactory width. The height of such nests may exceed 5 inches and are acutely V-shaped in section. High nests also occur when the redstart builds over cowbird's eggs deposited before its own eggs have been laid.

It requires a week or ten days for the industrious female to build the nest. The task is performed in a most expert manner. The outside framework is first constructed, and then she enters the nest to adjust the lining, turning around and around and pressing her breast against the sides until the desired symmetry is attained. The final bits are dextrously manipulated by the bird's bill and seem to be pasted on, according to various observers, with the aid of her own saliva.

Louis Sturm (1945) observed the building of one nest, which he states was completed in the course of 2½ to 3 days. He estimated that the bird made 650 to 700 trips in building the nest. The first egg in this case was laid 2 days after the completion of the nest.

William Brewster (1936) presents a detailed account of the building of a redstart nest that is interesting and informative:

> At about 6 A. M. on May 17th a female redstart brought a long, transparent, silky-looking fiber—apparently that of a milkweed stalk—to a gray birch in front of the cabin and, placing it at the intersection of a rather stout branch with the main stem, began moving it about until its position suited her, when she pressed it down firmly by rubbing it with the side of her head which she turned slowly from side to side. This was literally the first bit of nest material that was put into the crotch. Many others of an apparently similar kind were brought during the forenoon and treated in the same way, although the bird had to use her bill rather vigorously in tamping some of the more refractory ones into place. She worked busily and steadily until noon when the foundation of the nest was finished.
>
> At about 2:30 P. M. she began the frame by attaching one end of a strand of fibrous material to the right hand side of the trunk a little above the branch on which the foundation was laid and fastening the other end to the foundation on the same side, the strand inclining downward at an angle of about 30° or 40°. Next, another strand was placed on the left side in the same position as the first, the ends of the two overlapping on the trunk. Then a third piece was brought and one end rubbed lightly against the center of the strand on the right, the opposite end being carried a little beyond that of the left hand strand. Next a fourth strand was rubbed on the trunk a little above the upper end of the left hand guy, to the middle of which the opposite was fastened by rubbing the two together. Each piece of fiber was fashioned into the general shape of the nest as soon as it was attached to both ends and more were brought and carried from point to point until a complete framework of about the size and shape of the half of a hen's egg was erected around and resting on the foundations. This framework was so delicate that it looked as if the merest breath of wind would blow it away. During its construction, the bird worked entirely from the outside, standing on the branch and shaping each piece of fiber with her head.
>
> The next day (May 18th) she began using cocoon fibers as well as milkweed bark. The former she obtained from a groove near the top of the cabin door in front of which she would hover on rapidly vibrating wings until the exertion compelled her to alight for a moment to rest and regain breath, either on top of the door or its hand knob. As soon as she had filled her bill, she would fly to the birch, alight on the branch and distribute her load around the inside of the nest; then, hopping into it and squatting down with her head and tail raised and back deeply hollowed, she would move slowly around to the right

and then to the left, making usually a half but sometimes a whole turn and, with her head and breast, pressing the materials which she had brought into the meshes of the framework until they were completely filled. Working thus, always from the inside, she modeled and remodeled until by the constant application of fresh material she had transformed the original skeleton framework into a compact, firmly-woven nest. Occasionally she would drop directly into the nest without first alighting outside but she did not attempt to perch on its rim until it was nearly completed.

After putting in the lining, which consisted of horse hair, dry grass, and shreds of birch, grapevine and mullein bark, she drew the loose ends which had been left projecting or hanging down around the outside of the nest. These ends were drawn and tucked in to bind the lining and were held down by the bird's breast until all within her reach were secured. She then managed to rub them still more firmly into place by craning her head over the rim of the nest and bringing her bill, throat and neck to bear on its top and inner and outer surfaces at one and the same time.

After this nest was finished, it was frequently visited by Black and White Creepers, Yellow Warblers and Red-eyed Vireos, all of whom attempted to appropriate some of its component materials for their own domiciles. They sometimes succeeded in getting away with a few strands despite the vigilance of the Redstart, who defended her castle with the greatest spirit.

Eggs.—The usual number of eggs in a complete set of the redstart is 4 but the total ranges from 2 to 5 (I have never found a set containing more than 4 eggs) ; this number seems to vary in different sections of its range. J. Claire Wood (1904) reported that out of 143 nests with eggs 9 of them had 5 eggs; other observers have reported finding 5 eggs, but sets of more than 4 eggs are not common. Although the first set generally consists of 4 eggs, if these are destroyed the second set seldom exceeds 3 eggs and very often there may be but 2.

The eggs are subject to considerable variation in their size and markings; the average short diameter of a series of 50 eggs is 12.3 millimeters and the average long diameter 16.2 millimeters. They are ovate but some tend toward short ovate. They have a slightly glossy texture with a ground color that varies from white to creamy-white, greenish white, or grayish white. The eggs are speckled, spotted, and frequently blotched with various shades of brown with undertones of gray and drab. There is generally a concentration of markings at the larger end, forming a distinct wreath. The amount and intensity of the markings vary; some eggs may be almost free of markings, on others the markings are so dense as to nearly conceal the ground color.

Incubation.—The period of incubation is 12 days, and is performed entirely by the female. Normally only one brood is reared during any one season.

B. W. Baker (1944) in 3 hours of observation at a nest during the morning noted that the female left the nest seven times, the length of her absence varying from 2 to 10 minutes, while the time spent on the nest was 144 minutes or 80 percent of the observation time. In nests that I have had under observation in Maine, the male was seen to deliver food to the female at frequent intervals and perhaps for this reason these females left the nest less often.

A. D. DuBois writes to me of an interesting reaction of a nesting female to a mirror: "The spunky little female flew at a small mirror which I held over the nest on the end of a stick; she snapped her bill and even grew bold enough to peck at it. On June 3 she again fought the small mirror as I held it up to look into the nest, but she returned to her eggs immediately when I withdrew the obnoxious looking-glass."

Young.—In one nest under observation at Brunswick, Maine, the first egg hatched while the adults were away from the nest. The male was the first to return to greet the youngster and his first act after an inspection of the nest was to remove the eggshells. The male also delivered the first food, a small minced larva, when the young was about 2 hours old. When the female returned, which was shortly after the male's first visit, she carefully inspected the nest, then immediately settled down to brood the young and the three eggs. The male never brooded but he was very attentive in feeding the young. If the female was at the nest when he arrived, the food was presented to her and she in turn fed it to the young, but if she was away the male fed the young directly. On the first day the youngster was brooded 75 percent of the time. There were three young on the following day, and the fourth egg proved to be sterile. The amount of time required for brooding was more or less dependent on weather conditions. On a cool, rainy day more time was spent on the nest than when a moderate temperature prevailed. When it rained the female extended her wings over the edge of the nest and her head was directed upward toward the oncoming rain drops. She thus provided an effective roof to shield the helpless young from a disastrous soaking. The brooding instinct is very strong and if the young were removed from the nest for purposes of study and photography, the female mechanically brooded the empty nest the entire time the young were out, seemingly unaware of their absence. In the afternoon the nest was exposed to the direct rays of the sun and on hot days the female perched on the edge of the nest with her wings half spread and her back toward the sun. At such times she panted incessantly in order to control her temperature through her intricate air-sac system. It is just as necessary for the adult to protect the young from heat as it is to keep them warm on cool days. The amount of time spent in brooding becomes much reduced as the young grow older, and by the time they have attained their covering of feathers and acquire a temperature control there is little need for brooding.

The male, if it is an old bird, usually exhibits greater wariness in approaching the nest than does the female. Miss Cordelia Stanwood has found the reverse to be true of one first-year male, which seemed to show no fear at all of her presence at the nest, whereas the female hesitated to feed the young at such times. Perhaps the older bird's wariness is due to more experience in life.

The part played by the two sexes in feeding the young varies with different individuals; usually both take an equal part, but at times either the male or the female may take the major responsibility. Miss Stanwood studied a nest of the redstart in which the female had disappeared, apparently killed. In this case the male took over all of the arduous duties of feeding the family and of caring for them after they left the nest. Since the young are fed 8 to 10 times every hour it takes the resourcefulness of both parents, let alone one, when a mate is lost.

At the time of hatching, the young have their eyes closed and are naked except for limited tufts of down found on the dorsal tracts including the crown. By the third day the eyes show slightly through very narrow slits and the papillae of the wing feathers make their appearance. By the sixth day the tips of the feathers are unsheathed; from this time on the young preen their feathers a great deal and they may be seen picking at the growing feathers, an action that apparently accelerates the unsheathing process. By the eighth day the juvenal plumage is well established, and the young may leave the nest but if not disturbed or excited usually remain a day longer.

Bernard W. Baker (1944) found the weight of a young on the day of hatching was 1.1 gm. and at 7 days the same young had increased its weight to 7.5 gm. The tarsus of the same bird was 6 mm. in length on the first day and 17 mm. on the seventh day.

As with other warblers, the nest is kept scrupulously clean not only of vermin but of the feces, which are anticipated and disposed of as soon as they appear. During the first two days the fecal sacs are swallowed by the adults, but as the young grow older, more and more of them are carried away and dropped at some distance from the nest. This task, like that of feeding the young, is performed by both parents.

J. Claire Wood (1904) presents an interesting account of a nest of seven eggs which was shared by two pairs of birds, as follows: "When found one female was upon the nest and the other perched close beside it. They were equally demonstrative of anxiety as I ascended the tree. The eggs were in two layers and slightly incubated. Being of two distinct types there was no difficulty in separating them into sets of three and four. This was not a case of polygamy, as both males were present. All four were living in perfect harmony and understanding, which is remarkable from the fact that the males are inclined to pugnacity and firmly attack all intruders of their kind that invade their chosen territory." Whether or not polygamy ever exists among redstarts, as with the ovenbird, to my knowledge has never been determined.

Dr. A. F. Skutch describes an injury feigning performance of a pair of adult redstarts which he observed at Ithaca, N. Y., on June 13, 1931. These birds apparently had young in the vicinity. He writes: "While passing through a tract of low, swampy woods, I was led by the excited chirping of a pair of American redstarts to the discovery of their nest in the crotch of an elderberry bush about 9 feet above the ground. When I attempted to learn by feeling with my finger-tips what it contained, the birds gave such a demonstration as I have seldom witnessed. The female approached the closer to me, advancing within easy reach as she chirped her distressed reproaches; but the male, although he remained at a somewhat greater distance, was more active in his efforts to lead me away. Although I felt that to them it was a most anxious occasion, I confess that I deliberately prolonged their agony that I might delight my eyes with the gorgeous display of the male redstart as he perched on a long twig with tail spread and wings fully extended, vibrating—it seemed to me—as rapidly as a hummingbird's. What a splendid color-contrast in the full black and the orange-salmon of the wings flashing into a blur, while the rich colors of the relatively motionless tail showed so clearly! Descending to the broad surface of a skunk-cabbage leaf, he continued his manifestations of distress—but how can so airy and refulgent a creature convincingly express despair? Next, falling to the ground, he danced over it with spread tail and fluttering wings; but it impressed me rather as some fairy dance than a wounded bird attempting to avert grave danger from his nest. The female redstart's display was similar but less intense, while her paler colors made it less spectacular. When next I returned my attention to the nest, I found it empty. Since it is inconceivable that the birds should have become so excited over an empty nest, I had no doubt that fledglings were hiding close by, possibly having scrambled to safety while my delighted eyes were fastened upon the parents. The attendants of tender nestlings in a nearby nest made no such demonstration upon my approach."

Adults feeding young out of the nest are commonly seen throughout the month of July. There is a tendency for them to remain in the vicinity of the nesting site, but they are less noisy than the young of other species and hence are much less in evidence.

Plumages.—The plumage of the redstart is distinctive and can be easily distinguished from those of other warblers. The young males, even those in the first nuptial plumage, are similar to the females;

and, hence, the identification of the sexes of the younger individuals is more difficult.

The natal plumage is hair-brown and is present as small tufts located on the crown and various tracts of the dorsal part of the body.

The juvenal plumage is well established at the time the young leave the nest and in the course of a few weeks is completed with all of the feathers unsheathed. Jonathan Dwight, Jr. (1900), has described the juvenal plumage as follows: "Above, including the sides of the head, deep sepia-brown. Wings and tail deep olive-brown, the basal portion of the primaries, secondaries and outer rectrices pale lemon-yellow, the secondaries and tertiaries edged with dull olive-green, the coverts with wood-brown paler at the tips. Below, pale primrose-yellow, hair brown on the chin, throat and breast. Bill and feet dusky pinkish buff darkening to brownish black when older."

George A. Petrides (1943b) studied the plumage of a young redstart which he kept in captivity after it had left the nest. He found that at 10 days of age the tail feathers began breaking out of their sheaths; at 13 days the yellow areas on the wings first appeared and by 20 days the yellow patches of the tail became completely exposed. It was not until the young were 26 days old that the yellow patches of the wings were fully visible.

When the bird was 22 days old the slate-gray juvenal plumage of the occipital and dorsal tracts was being replaced in quantity by the olive-green first winter plumage. The yellow underwing coverts also began to appear at this time; previously the underwing areas had been naked. The postjuvenal molt was thus begun before the juvenal plumage was fully acquired.

The first winter plumage involves changes in the body feathers and wing coverts but not the rest of the wings or the tail. Dwight (1900) describes this plumage as follows:

> Unlike the previous plumage. Above, the pileum, nape and sides of neck mouse-gray, the back olive-green, often tinged with brownish orange, the upper tail coverts clove-brown. The wing coverts become dull olive-green. Below, dull white, ashy and pinkish buff suffusing the chin and throat, and orange-ochraceous or deep chrome-yellow area on either side of the breast, the color tinging the breast and sides. Orbital ring, white.
>
> First nuptial plumage acquired by a partial prenuptial moult, which involves chiefly the head and throat, where a few black feathers in patches are acquired. A few may be found scattered sparingly elsewhere and new white feathers on the chin are the rule. Abrasion and fading make birds paler above and whiter below. In this species, which is unique among our warblers during the first breeding season in wearing an immature dress strikingly different from the adult, the renewal is reduced to a minimum.
>
> Adult winter plumage acquired by a complete postnuptial moult in July. The black and orange-red dress is assumed, the black feathers often having a faint buffy edging. Sometimes the orange basal part of the primaries or of the rectrices fails to develop and yellow, as in the first winter, takes its place.

> Adult nuptial plumage acquird by wear. The abrasion of the black plumage is in places so slight that there might be some replacement by new feathers, but it is not apparent. Fading is not obvious, except of the flight feathers.
>
> The plumages and moults [of the female] correspond to those of the male. First differs in first winter plumage which is browner, the breast patches merely yellow tinged and the basal part of the rectrices much paler yellow, this color usually absent from the base of the primaries and reduced in extent on the secondaries. Some specimens are much like males. The first nuptial plumage is acquired by a very limited, sometimes suppressed prenuptial moult. The adult winter plumage is scarcely different from the first winter, a little grayer on the back and the yellow area on the wings greater. The adult nuptial plumage is apparently the previous plumage plus wear.

Pure and partial albinistic and melanistic forms of the redstart have been reported.

Thos. D. Burleigh (1944a) describes a hybrid between the redstart (*Setophaga ruticilla*) and the parula warbler (*Composothlypis americana*) which he secured on Cat Island, Miss., 9 miles offshore from Gulfport:

> This specimen bears a superficial resemblance to the female Redstart but close scrutiny reveals marked differences. The bill is not broadly wedge-shaped as in the Redstart, and the rictal bristles are developed only to the same degree as in the Parula Warbler, in this respect differing markedly from the genus *Setophaga*. The wings have the middle and greater wing-coverts broadly tipped with dull white, forming two distinct bands, and there is a complete absence of the speculum on the inner remiges. The tail, although noticeably longer than in the genus *Compsothlypis*, lacks the yellow characteristic of *Setophaga;* this basal portion of the outer rectices is dull white instead. The color pattern of the upper parts is distinctly that of the Parula Warbler, and while duller in hue, the olive green of the mantle is in contrast to the color of the lower back. On the other hand, the under parts suggest the Redstart, the throat being dull white rather than yellow, with the median portion of the breast tinged with light salmon.

Food.—There has been no comprehensive study made of the food of the redstart based on an examination of the contents of a representative number of stomachs, but many field observations clearly indicate that it is strictly insectivorous in its food-eating habits. The insects it eats are extremely varied; it gleans them in the form of eggs, larvae, pupae, and adults from the trunks, limbs, twigs, and leaves of trees; and it is most adept in capturing insects in the air. There are few small forest insects, whatever their stage of development, that escape this active and resourceful warbler, so busy is it in pursuit of its prey. Even the caterpillars that escape from other slower warblers by hanging by their silken fibers are readily snatched up by this aerial acrobat. It feeds on insects injurious to deciduous trees and in Maine it frequents the coniferous forests to supplement its food supply. I have frequently seen it snap up flies and tiny midges, mosquitoes, and black flies, all of which, though not injurious to vegetation, are most annoying to human beings. It feeds upon a great variety of caterpillars including the smaller hairy types. It may be seen in orchards, where various observers have noted its fondness for cankerworms, and it has also been seen to feed on brown-tail and gipsy moths. Forbush (1907) saw one redstart eat 31 gipsy moth larvae before it left the clump of willows in which he was able to watch it at close range. At another time he saw a redstart take 11 brown-tail larvae from an apple tree in the course of 5 minutes.

W. L. McAtee (1926) in his study of the relation of birds to woodlots in New York State writes: "Rations for the Redstart consist entirely of insects, spiders, and daddy-long-legs. Beetles, including flea beetles, leaf beetles, and round-headed wood borers; caterpillars and moths; and such true bugs as spittle insects, tree hoppers, and leaf hoppers are commonly taken. The Redstart devours also some hymenoptera, mayflies, and diptera including craneflies. Busy at all times in the pursuit of insect prey, the Redstart in the long run must account for vast numbers of the forms injurious to trees."

While the vast majority of the insects eaten by the redstart are harmful to man's interest it must be admitted that it does feed on a few beneficial insects such as the parasitic Hymenoptera and Diptera as well as an occasional ladybird beetle which are classed as useful.

Although the redstart is preeminently an insect destroyer it has been known to eat berries and seeds on rare occasions. Aretas A. Saunders (1938) reports that in Allegany State Park, N. Y., they feed on shadbush berries; George A. Petrides (1943) reported them feeding on the berries of *Berberis bealei;* and A. H. Howell (1932) states that in addition to its usual food, while the birds are migrating through Florida, it feeds on magnolia seeds as well as on spiders, plant lice, and scale insects.

Alexander Wetmore (1916) reported on his examination of the food found in 13 stomachs of redstarts, which he collected in Puerto Rico during the months of December, January, February, and April, as follows:

> In these animal food amounts to 100 per cent. Small lantern flies (*Fulgoridae*) occur nine times and form 37.23 per cent of the total. Longicorn beetles make up 0.57 per cent, snout beetles 1.5 per cent and miscellaneous species 2.54 per cent. All are classed as injurious species save a single ladybird beetle, so small that it is lost in the bulk of the others. Moth remains amount to 11.75 per cent, while no caterpillars were eaten. Hymenoptera remains (6.67 percent) were found in five stomachs. Approximately two-thirds of these small species, probably of parasitic habit. One that parasitizes ants was definitely identified as a species of *Kapala*. Diptera (39.24 per cent) were present in eight of the stomachs examined. One bird had eaten a spider, and another insect eggs, both amounting to only 5 per cent.
>
> Though present only in winter, this small warbler is a bird of economic importance. It destroys thousands of lantern flies, abundant in the trees and

shrubbery, as well as many beetles, moths, and flies. A very small percentage of its food is taken from beneficial species of insects, the remainder being entirely injurious. This bird is entirely insectivorous and does not feed upon any of the abundant wild berries, a fact which increases its importance, as it destroys proportionately more insects than do the more or less vegetarian resident species of similar habit.

Small larvae and tiny insects are fed to the young by the adults during the first days of nest life but as the young become older and their demands for food correspondingly greater they are fed larger insects such as adult moths, beetles, locusts, and craneflies. Bernard W. Baker (1944) in observations made of nesting redstarts in northern Michigan writes: "Various kinds of insects and larvae were fed to the young—Mayfly (*Ephemera*), Rosy Maple Moth larvae (*Dryocampa rubicnda*), House Fly (*Musca domestica*), and many others I could not identify. During a Mayfly hatch 90 per cent of the insects brought to the nests were Mayflies. It was not unusual for the male to bring in two or three Mayflies and feed two young on one trip. On one occasion a male brought four Mayflies at once and fed three young."

The young are usually fed from 4 to 15 times during the course of an hour. At one nest under observation the young were fed by the female 28 times and by the male 22 times during the course of 9 hours. The feeding intervals varied from 1 to 25 minutes, with an average of about 10 to 11 minutes between feedings. Ira N. Gabrielson (1922) who observed a nest of young at Marshalltown, Iowa, states that during the course of 5½ hours the nestlings had 30 feedings, 10 of which were by the female and 20 by the male. During these feedings he recognized 22 winged insects, 16 larvae, 1 fly, and 1 spider, but in some cases he was unable to determine the character of the food.

It is obvious that the redstart can be classed as a bird very useful to man's interests because of its destruction of many harmful insects.

Voice.—The song of the redstart is not especially pleasing nor is there any outstanding feature of the song except its extreme variation and the different versions in which it occurs. It is a short monotonous *weechy* type and of a high-pitched sibilant quality. I have often been mystified by the vagaries of this versatile singer. The beginner may at first confuse the song with that of the yellow warbler, which it resembles, but the latter is longer and has a different ending. The fundamental difference between the two is a tendency of the song of the yellow warbler to accelerate while that of the redstart retards. Sometimes the redstart will emit a series of notes that are weak and *buzzy* and suggest the parula's song, and again they will be like the shrill notes of the blackpoll or the loud *wheeze* of the black-throated blue warbler.

Aretas A. Saunders has sent us his interpretation and analysis of the redstart's songs, as follows: "The song of the redstart is not loud, but certain notes are sometimes strongly accented. In 59 records, the songs contain from 4 to 11 notes, averaging about 7. They occupy from 3/5 to 1 2/5 seconds.

"The song varies in pitch from G''' to E''''. Individual songs vary from no change in pitch to a change of three tones. Three of my records are all on the same pitch. Four change pitch only a half tone. Only one has a range of three tones. The average range is just about one and a half tones.

"Songs begin with a series of simple notes or of 2-note phrases. The former sounding like *tseet*, *tseet*, *tseet* and the latter *tseeta*, *tseeta*, *tseeta*. Songs may end in three different ways; the first just as it began, without change to the end; the second with a single, strongly accented, higher-pitched note; and the third by a downward slur, strongly accented at the beginning. These two latter forms may be represented as *tsita*, *tsita*, *tsita*, *tseet* and *tsit*, *tsit*, *tsit*, *tsit*, *tseeo*. Of my records, 15 are of the first form, 18 of the second, and 26 of the third.

"These three different songs may all be sung by one individual and there is nothing seasonal about their use. The bird frequently alternates two or more songs, sometimes regularly, sometimes one is sung three or four times as often as the other. One bird sang four different songs one after another, but the order varied with each repetition. So far as I know, this is the only warbler that sings different songs in alternation.

"The redstart sings from the time of its arrival until the middle of July. The average date of the last song, based on 14 years of observation in Allegany State Park, is July 14. The earliest is July 2 (1927) and the latest July 25 (1937)."

In northern New York, A. Sidney Hyde (1939) states that no songs of the redstart are heard in late July but that songs were regularly heard from August 1 until September 2. Several birds were singing with almost full springtime vigor at Irondequoit Bay on August 20.

Eugene P. Bicknell (1884), in writing of the late singing of the redstart, says:

> In some years I have found this species songless soon after the beginning of July. In seasons when it thus early becomes silent singing is resumed in the first part of August, and continues for two or three weeks. But the period of July silence is inconstant, and sometimes singing is little interrupted through the month. When this is the case singing seems to cease finally at the end of the month or early in August, and is followed by no supplementary song period. * * * My dates of last songs are limited by the third week of August, except in one exceptional instance when one of the birds was heard to sing on September 5.

A number of observers have reported seeing the female sing, the song being about the same in quality and length as that of the male.

It has been suggested by critics that these reports were based on seeing the first-year male, which has a plumage similar to that of the female and could be easily mistaken for a female. The male breeds the first year in this plumage and this adds to the confusion. However, it has been definitely proved that the females do sing at times. J. L. Baillie, Jr. (1926) collected a female at Lowbush, Lake Abitibi, Ontario, on June 3, 1925, which was singing one of the usual songs of the male, including the usual *swee-a*, *swee-a* notes. The specimen was carefully sexed and was found to have enlarged ovaries; hence, no mistake was possible. On June 22, F. W. Braund (Braund and McCullah, 1940) heard what appeared to be a singing male on Anticosti island. When seen it was thought to be a young male in immature plumage in full song, but after it was collected and sexed it proved to be an adult female. These and other similar cases indicate that some females sing the full song of the males, although it is unusual for them to do so.

Albert R. Brand (1938) has determined the vibration frequencies of the songs of many passerine birds from motion-picture film recordings. The highest note in the song of the redstart had a frequency of 7,300 vibrations per second, the lowest 4,400, and the approximate mean of 6,200 vibrations per second. It is of interest to compare the mean of the redstart with that of the blackpoll warbler, which has a mean of 8,900, whereas the mean of the yellow-breasted chat is only 2,600 vibrations per second.

Horace W. Wright (1912) has observed the early morning awakening of birds at Jefferson Highlands in the White Mountains of New Hampshire. Of the redstart he writes: "If the Ovenbird is excepted, the Redstart introduces the warbler singing. All warbler song is delayed on the average until 3.29, when the Ovenbird begins to sing. The Redstart based on ten records, averages to sing seventeen minutes later, or at 3.46 o'clock. It has been heard once as early as 3.26, but on three other occasions was first heard at 3.55. 3.56, and 3.58 respectively. Two and sometimes three birds sing within hearing. On June 28, 1911, the first bird began to sing at 3.41, the second was heard at 3.49, the third at 3.52, and the three continued singing much of the time up to 5.15 o'clock." He states further that the Redstart was one of only three warblers which were heard to sing after sunset, which at the time the records were taken was at 7.30 p. m.

Enemies.—The redstart's habit of nesting in rather tall slender trees, usually at a considerable distance from the ground, frees it from most of the enemies to which ground-nesting birds are subject. However, I know of one nest of the redstart, built in a shrub about 4 feet above the ground, that was destroyed by a cat, and of another, also located in a shrub near a house, that was quite probably destroyed by one. However, since the vast majority of redstarts build in locations remote from human habitations, cats are not an important factor in affecting the redstart population as a whole.

John and James M. Macoun (1909) cite a case of a redstart's nest, built in an exposed position, that was presumably destroyed by an olive-sided flycatcher that had a nest on an overhanging branch a few rods away.

C. H. Morrell (1899) states that two redstart nests which he observed were deserted after the eggs had been laid because caterpillars had taken possession of the nesting tree and had completely overrun the nests. E. H. Forbush (1907) in connection with a gipsy moth infestation at Medford, Mass., writes: "There was a nest of the American redstart and the tree had been stripped of leaves by the caterpillars. There were four young in the nest. I saw the old birds take but one very small gipsy moth caterpillar to the young, but they would pick the large ones off the nest and drop them to the ground very often. There were no pupae near the nest that I could see." Mr. Forbush does not state whether the redstarts succeeded in winning their fight against this caterpillar infestation.

Louis Sturm (1945) says that one nest that he observed "was robbed by a small fox snake (*Elaphe vulpina gloydi*) which had swallowed all three eggs when discovered coiled in the nest."

The redstart, like most birds, is host to a number of external parasites, of which Harold S. Peters (1936) has identified the three species of lice *Menacanthus* sp., *Myrsidea incerta* (Kellogg), and *Philopterus subflavescens* (Geoffroy) and the tick *Haemaphysalis leporis-palustris* Packard.

Perhaps the greatest menace to the redstart is the parasitic cowbird, of which this warbler is one of the commonest victims. According to Herbert Friedmann (1929) at Ithaca, N. Y., the redstart was the most imposed upon species. Out of 34 nests he found 23 of them contained one or more of the parasitic eggs and it was not uncommon to find sets composed of but one or two of the rightful eggs, the rest being the cowbird's.

Occasionally the redstart builds a new floor over the cowbird's eggs, as is often done by the yellow warbler. This procedure is especially likely to take place if the cowbird succeeds in laying its eggs before the redstart's eggs are present. More often the redstart does not seem to be annoyed by the strange eggs but goes on laying its own. It is unusual for the redstart to desert its nest because of the presence of cowbird's eggs.

A nest was found on June 9, 1922, with two young cowbirds 5 days old, completely filling and covering the nest. In the bottom beneath the young parasites were four addled eggs of the warbler. If some of the rightful eggs hatch, the young are usually starved or suffocated by the young cowbirds, although nests are occasionally found in which one or more of the young survive along with the interloper.

In discussing the effect of this parasitism on the redstart Friedmann adds: "When a cowbird is raised by a one-brooded species such as the redstart it represents the total product of its pair of foster-parents for the year. The loss here is a very decided one if we consider the food consumed by one cowbird and that which would have been eaten by four Redstarts. However, judging from the constancy of the numerical status of the Redstart from year to year it seems as though three of the four young would succumb anyway to various dangers before the next year. Also we must remember that the Redstart is in many places more abundant than the cowbird."

Joseph J. Hickey (1940) writes: "Males were silent in the presence of female Cowbirds, but females reacted with sharp hisses, a rapid snapping of the bill and much spreading of the tail." Friedmann (1929) writes: "On July 2, 1921, a young Cowbird, full grown in size and fully fledged was seen following a Redstart and begging for food from it. The Redstart paid absolutely no attention to it although several times the two were very close together. All this time the Redstart was busy gathering food and when it had as much as it could carry it flew off and the young Cowbird did not follow."

Dayton Stoner (1932) gives an account of an interesting experience of the behavior of redstarts as follows: "I saw one female carrying food for young. Another female was seen feeding a young cowbird that was out of the nest and able to fly, while an adult female cowbird sat on a limb nearby and apparently watched the proceedings. The female cowbird did not offer the young one any food, but after the latter's wants had been satisfied in some measure by the diminutive redstart, she moved close to the young one and at least *appeared* to be solicitous of its welfare. But any maternal solicitude involving real care of the young was utterly foreign to this parasitic bird."

Fall.—The redstarts start migrating from the most northern sections of their nesting range in August but it is well into September before the last individuals leave these outposts. The individuals breeding in British Columbia near the Pacific Ocean do not follow the Pacific flyway but retrace their path across the mountains to the interior and leave the United States between Texas and Florida, their point of entry. In recent years an increasing number of redstarts have nested in Washington and Oregon, and there are many records of occurrence, especially during the time of migration, throughout California and southward. This may mean a building up of a tendency of the individuals nesting in the northwest to use the Pacific flyway, which in the course of a few hundred years may become a regular migration route for these Redstarts.

At Point Pelee, Ontario, according to Taverner and Swales (1908) the bulk of the redstarts pass through during the first week of September but are fairly common during the latter part of the month. In Maine the bulk of the redstarts leave by the middle of September but in southern New England and New York there are many records of redstarts throughout the month of October.

In Ohio and the Middle West there is a distinct movement of redstarts early in August and the peak of the migration takes place from August 20 until September 25. A sharp decrease takes place during the last few days of September, and by October 5 the species disappears except for an occasional straggler.

Thomas D. Burleigh (1944b) in discussing the fall migration on the Mississippi Gulf coast writes: "The first birds to appear are always young of the year, and although a few females are seen early in August, it is not until after the middle of the month that the males are observed. During September the Redstart occurs in its greatest numbers, and there is usually an occasional day after the middle of the month * * * when these warblers are found literally everywhere." Mr. Burleigh's latest fall record is November 10, 1937. In Florida the largest flights also occur about the middle of September, and at this time many are reported killed at the lighthouses. Many are seen throughout October and some late fall records are: Pensacola November 19, 1929; Fort Pierce November 2, 1918; Fort Drum November 3, 1888; and Sombrero Key November 4, 1888.

According to F. C. Lincoln (1935), redstarts, evidently the more southern breeders, are seen returning southward on the northern coast of South America just about the time that the earliest of those breeding in the North reach Florida on their way to winter quarters.

Winter.—The redstart may be found in the West Indies from August until the following April. In Cuba, according to Thomas Barbour (1923), "the Redstarts are the first sign to the Cubans that the migration is on, and they probably are the very last northern visitor to leave in the spring. They are excessively abundant in thickets and woods everywhere, even in the cities. Except for the Palm Warbler, no bird is more in evidence during the winter than the Candelita—the little flame. The North American observer never would dream that there could be enough redstarts gathered together from all the bird's range to make up the hordes which come to Cuba."

Alexander Wetmore (1916), in his account of the birds of Puerto Rico, writes of the redstart: "These birds frequent the mangroves, forest growths, and coffee plantations, and sometimes shade trees about houses. The greater portion seen were immature birds and females, though occasionally males in full plumage were observed. As always, these birds were very active, searching through the limbs for insects, and expertly catching insects on the wing. On El Yunque, in the dense forests, they were seen up to 1,500 feet altitude, and elsewhere in more open locations were found in the highest elevations. Next to the parula warbler this is the most common of the wintering warblers." In Haiti and the Dominican Republic, Wetmore and Swales (1931) found that "the redstart frequents shrubbery, groves and forests, where it is a most active flycatcher, pursuing its living prey with dash and vigor among the branches with much display of its brilliantly marked, fan-shaped tail. It ranges from coastal thickets to the summits of the mountains."

Todd and Carriker (1922), in their account of the birds of the Santa Marta region of Colombia, state that the redstart is "an abundant bird during the winter months in the mountains, but much rarer in the lowlands. Its habits are practically the same as in the north, except that it does not sing. Simon speaks of finding it in the densest forest in the tops of the highest trees, where it is hard to see." The earliest fall arrival date reported by the authors was August 24, 1898, and the latest spring date May 1, 1913.

Dr. A. F. Skutch has written us an account of the redstart as he found it wintering in Central America as follows: "First appearing in Central America in mid-August, the redstart spreads rapidly over the lower portions of the whole great isthmus. Although during its periods of migratory flight it is at times met in the highlands, even up to an altitude of 8,000 feet, like the majority of the warblers that breed in the Austral region of North America it prefers the warmth of the lowlands. Once it has settled down in its winter home, it is only rarely found as high as 5,000 feet. At lower altitudes, it is a fairly common winter resident throughout the length and breadth of Central America. Although not rare on the Pacific side, it is more numerous in the Caribbean lowlands. In the northern lowlands of Honduras and Guatemala, it is very much in evidence during the winter months, and may be expected wherever it can find trees in which to forage. Incessantly active, it retains in the Tropics the same sprightly ways that make it a favorite of northern bird-lovers, and as it weaves skillfully through the boughs of the trees in pursuit of insects on the wing, conspicuously displays the bright orange or yellow areas on its sides, wings and tail. Like nearly all of the warblers that winter in the lowlands, it is quite solitary during its sojourn in Central America, never associating with others of its own kind. I have not heard it sing while in the Tropics.

"Like the black-and-white warbler, the redstart begins to withdraw from Central America considerably earlier than many other of the wintering warblers. As a rule, it disappears from Costa Rica before the end of March. I have April records for only two individuals, one of which, a female, lingered as late as the sixth. In Guatemala, however, it has been reported as late as May 6."

DISTRIBUTION

Range.—North America, south to the West Indies and northern South America.

Breeding range.—The redstart breeds **north** to northern British Columbia (Atlin, Telegraph Creek, and Liard Crossing); Yukon; central western and central southern Mackenzie (Fort Norman, Fort Wrigley, Fort Simpson, and Fort Resolution); central Saskatchewan (Emma Lake and Cumberland House); southern Manitoba (Duck Mountain and Berens Island); central and northeastern Ontario (Kenora, Lac Seul, Rossport, and Moose Factory); central western and southeastern Quebec (probably Rupert House, Mistassini Post, Godbout, Matamek, Mingan, and Anticosti Island); and Newfoundland (Bay of Islands, Twillingate, and Fogo Island). **East** to Newfoundland (Fogo Island); Nova Scotia; New Brunswick; Maine (Andover and Auburn); New Hampshire (Hollis); Vermont (Newfane); Massachusetts; New York; southeastern Virginia (Dismal Swamp); central North Carolina (Charlotte and Raleigh); and central Georgia (Atlanta, Macon, rarely Americus, and once in Savannah. **South** to central Georgia (Savannah); central Alabama (Greensboro, Booth, and Seale); central Mississippi (Edwards); northwestern, central and southeastern Louisiana (Mansfield, Natchitoches, Lottie, and Diamond); central and southeastern Oklahoma; central northern Colorado (Central City, Longmont, and Boulder); and central Utah (Provo). **West** to central Utah (Provo and Parleys Park); northeastern Oregon (probably Minan); central northern Washington (Winthrop and Chelan); and western British Columbia (Hagensborg, Pemberton, and Atlin).

Winter range.—The redstart winters **north** to southern Baja California (Miraflores); Veracruz (Presido and Tres Zapotes); Yucatán (Chichén-Itzá); Quintana Roo (Holbox Island and Cozumel Island); Cuba (Mariel, Guamo, and Gibara); rarely the Bahamas (Green Cay, Andros, New Providence, and Great Inagua); Hispaniola (Fort Liberté, Sousa, and Sánchez); and Puerto Rico (Mona Island, Mayagüez, and Culebra Island). **East** to Puerto Rico (Culebra Island); the Lesser Antilles (Virgin Islands, Barbuda, Antigua, Dominica, Santa Lucia, Grenada, Tobago, and Trinidad); and British Guiana (Mount Roraima and Bartica). **South** to British Guiana (Bartica); northwestern Brazil (Sierra Imeri); and Ecuador (Zamora). **West** to Ecuador (Zamora, Quito, and Esmeraldas); Puebla (Metlatoyuca) and southern Baja California (San José del Cabo and Miraflores).

The range as outlined is for the two recognized races. The Southern redstart (*Setophaga ruticilla ruticilla*) breeds from North Dakota to Maine, south to Georgia, Louisiana, and central and southeastern Oklahoma; while the northern redstart (*S. r. tricolora*) breeds from northern British Columbia to Nova Scotia, south to central northern Colorado, and west to central northern Washington and northeastern Oregon.

Migration.—Late dates of spring departure are: Ecuador—below San José, March 15. Venezuela—Rancho Grande near Maracay, Aragua, May 5. Colombia—La Tigrera, Santa Marta region, May 1. Panamá—Gatún, April 28. Costa Rica—El General, April 6. British Honduras—Mountain Cow, April 14. Swan Island—April 19. Guatemala—Chuntugui, May 3. Tabasco—Balancan, May 16. Virgin Islands—Kingshill, St. Croix, April 30. Puerto Rico—Cabo Rojo Light, April 26. Haiti—Île de la Gonâve, May 20. Cuba—Cienfuegos, May 13; Habana, May 11 (average of 8 years, May 4). Bahamas—Nassau and Cay Lobos Light, May 13.

Early dates of spring arrival are: Venezuela—Rancho Grande near Maracay, Aragua, February 27. Florida—Key West, March 6; Fort Myers, March 12; Pensacola, April 4. Alabama—Birmingham, April 1. Georgia—Milledgeville region, March 16; Athens, April 7. South Carolina—Clarendon County, March 24; Marion, April 2. North Carolina—Raleigh, April 2 (average of 27 years, April 12). Virginia—Charlottesville, April 13 (average, April 22). West Virginia—Kayford, April 10; French Creek, April 22 (average of 17 years, April 29). District of Columbia—Washington, April 16 (average of 53 years, April 22). Maryland—Largo, Prince Georges County, April 15. Delaware—Kent and Sussex Counties, February 28 (average of 22 years, March 20). Pennsylvania—Berwyn, April 3; Pittsburgh, April 21; Renovo, April 29 (average of 25 years, May 4). New Jersey—Bridgeton, April 23. New York—Bronx County, April 24; Ithaca, April 29. Connecticut—Hartford, April 22. Rhode Island—Providence, April 29. Massachusetts—Springfield, April 28. Vermont—Bennington, Wells River, and Bakersfield, May 4. New Hampshire—South Hooksett, May 2. Maine—Bowdoinham, May 3. Quebec—Montreal, May 4. New Brunswick—St. Stephen and Bathurst, May 12. Nova Scotia—Wolfville, May 3. Prince Edward Island—North Bedeque, May 24. Newfoundland—Tompkins, May 29. Louisiana—New Orleans and Grand Isle, April 7. Mississippi—Edwards, March 23. Arkansas—Helena, March 31. Tennessee—Nashville and Chattanooga, April 12 (average of 10 years at Nashville, April 20). Kentucky—Bowling Green, April 4. Missouri—southeastern Missouri, April 11. Illinois—Addison, April 9 (average for Chicago region, May 7). Indiana—Bloomington, April 12. Ohio—Oberlin, April 7; Buckeye Lake, April 25 (average May 2). Michigan—Ann Arbor, April 25. Ontario—London, April 30; Ottawa, May 3 (average of 17 years, May 16). Iowa—Wall Lake, April 21. Wisconsin—Milwaukee, March 20; Berlin, April 28. Minnesota—Lanesboro and Red Wing, May 2 (average of 45 years for southern Minnesota, May 10). Texas—Port Arthur, March 23. Oklahoma—Tulsa, April 16. Kansas—Manhattan, April 22. Nebraska—Red Cloud, April 5, April 17 (average of 20 years, May 12). South Dakota—Yankton, May 3. North Dakota—Cass County, May 7 (average, May 14). Manitoba—Brandon, May 8; Aweme, May 11 (average, May 15). Saskatchewan—Indian Head, May 12. Mackenzie—Fort Simpson, May 20. Arizona—Yuma, April 30. Colorado—Fort Morgan, May 5. Utah—Ogden, May 22. Wyoming—Careyhurst, April 30; average of 8 years for southern Wyoming, May 17. Idaho—Rathdrum, May 11. Montana—Billings, May 12. Alberta—Camrose, May 9. Nevada—Las Vegas, May 21. Washington—Cheney, May 19. British Columbia—Okanagan Landing, May 20. Alaska—Wrangell, June 9.

Late dates of fall departure are: British Columbia—Shuswap Falls, September 22. California—Verdugo, Los Angeles County, November 23; Pasadena, December 27. Alberta—Glenevis, September 22. Montana—Great Falls, October 3. Idaho—Moscow, September 4. Wyoming—Laramie, September 12 (average of 5 years, September 4). Utah—Uinta Basin, September 20. Colorado—Yuma, October 22. Arizona—Imperial National Wildlife Refuge, September 22. Saskatchewan—Wiseton, October 2. Manitoba—Aweme, September 28 (average, September 18); Winnipeg, October 26. North Dakota—Cass County, September 23 (average, September 17); Rice Lake, September 25; Fargo, November 1. South Dakota—Faulkton, October 15. Nebraska—Omaha, September 16. Kansas—Harper, September 21. Oklahoma—Tulsa, September 25. Texas—Cove, November 6, December 26. Minnesota—Virginia and Faribault, October 12 (average of 14 years for southern Minnesota, September 23). Wisconsin—La Crosse, October 11. Iowa—Sigourney, October 12. Ontario—Ottawa, October 3; Point Pelee, October 15; Toronto, November 28. Michigan—Detroit, October 11. Ohio—central Ohio, October 27 (average, October 6); Hillsboro, November 1. Indiana—Lake or Porter County, October 11; Carlisle, October 29. Illinois—Chicago, October 31 (average, October 8). Missouri—Keokuk, October 20. Kentucky—Danville, October 23. Tennessee—Elizabethton, October 19. Mississippi—Gulf coast, November 10. Louisiana—Baton Rouge region, November 7. Newfoundland—Stephenville, September 21. Prince Edward Island—North River, September 7. Nova Scotia—Yarmouth, August 31. New Brunswick—Saint John, September 25. Quebec—Montreal, October 6. Maine—Jefferson, October 11. New Hampshire—New Hampton, October 9. Vermont—Wells River, October 17; Bennington, November 11. Massachusetts—Cambridge, November 7; Belmont, November 16. Rhode Island—Little Compton, October 22. Connecticut—West Hartford, October 24; Windsor, November 25. New York—Ithaca, October 18; New York City, November 22 and 23, December 27. New Jersey—Englewood region, October 19. Pennsylvania—Sewickley, November 28; Lakemont, Blair County, December 25. Delaware—Kent and Sussex Counties, October 16 (average, September 10). Maryland—Patuxent Wildlife Research Refuge, October 16; White Marsh, December 6. District of Columbia—Washington, November 16 (average of 33 dates, September 20). West Virginia—Bluefield, October 12. Virginia—Cape Henry, November 28 (average, September 28). North Carolina—Raleigh, October 13 (average of 12 years, October 3); Statesville, October 16. South Carolina—Clarendon County, October 21. Georgia—Athens, October 27. Alabama—Birmingham, October 22, December 17. Florida—Pensacola, November 19. Bahamas—Cay Lobos Light, October 20.

Early dates of fall arrival are: British Columbia—Francois Lake, August 5. California—Monterey Park, August 30. Idaho—Jerome, July 7; Jensen, August 20. Colorado—Yuma, August 26. Arizona—Oracle, August 12. New Mexico—Kingston, August 24. North Dakota—Cass County, August 20 (average, August 27). South Dakota—Faulkton, August 15. Nebraska—Red Cloud, August 21. Oklahoma—Norman, August 30. Texas—Austin region, August 17; Brownsville, August 31. Iowa—Osage, August 11. Ohio—Buckeye Lake, July 23 (average, August 4). Illinois—La Grange, August 2; Chicago, August 9 (average, August 14). Mississippi—Gulfport, July 16. Maine—Bailey Island, July 30. Massachusetts—Chatham, August 27. New York—New York City, August 2. New Jersey—Milltown, August 6. Maryland—Patuxent Wildlife Research Refuge, August 12. Virginia—Cape Henry, September 3 (average, September 10). North Carolina—Washington, August 10. South Carolina—Clarendon County, July 18. Georgia—Athens, July 22. Alabama—Leighton and Birmingham, August 23. Florida—Alligator Point, Franklin County, July 19; Fort Myers, July 28. Cuba—Cienfuegos, August 6. Jamaica—St. Elizabeth, August 10. Dominican Republic—Constanza, September 22. Puerto Rico—Cabo Rojo, September 17. Barbuda, August 10. Guatemala—Puerto Barrios, August 21. Salvador—Lake Olomega, August 27. Honduras—near Tela, August 19. Costa Rica—El Hogar, August 16. Panamá—Almirante Bay region, August 27. Colombia—Santa Marta region, August 24.

Venezuela—Rancho Grande, near Maracay, Aragua, August 31. Ecuador—Esmeraldas, October 18.

Egg dates.—Illinois: 32 records, May 25 to July 21; 16 records, May 29 to June 6, indicating the height of the season.

Michigan: 14 records, May 25 to July 12; 7 records, May 30 to June 8.

Maine: 20 records, June 5 to 24; 11 records, June 10 to 17.

Massachusetts: 64 records, May 22 to June 30; 40 records, May 30 to June 6.

Nova Scotia: 13 records, June 3 to 25; 7 records, June 15 to 18.

Pennsylvania: 7 records, June 2 to 16 (Harris).

SETOPHAGA RUTICILLA TRICOLORA (Müller)

NORTHERN AMERICAN REDSTART

Contributed by James Lee Peters

HABITS

The name *Motacilla tricolora* was applied by Müller (1776) to a colored figure of a redstart in Daubenton's Planches Enluminées (1765, pl. 391, fig. 2), Müller apparently not recognizing that this figure actually represented the bird named *Motacilla ruticilla* by Linnaeus in 1758. Müller's name remained in the synonymy of *ruticilla* until resurrected by Oberholser (1938) who applied it to a western race of redstart which he characterized as differing "from the eastern form in smaller size, smaller orange or yellow wing spot; in the female also paler, more grayish, less conspicuously olivaceous, upper surface."

As breeding range he assigned northern British Columbia, Mackenzie, and central Manitoba, south to Oregon, northern Utah, and Wisconsin; he believed that it migrated through the greater part of the United States and wintered in South America to Ecuador and French Guiana. Wetmore (1949) found that the characters given by Oberholser for distinguishing *S. r. tricolora* from *S. r. ruticilla* did not hold, and the range of the former was more extensive than supposed. As a result of his investigations Wetmore found that the size of the wing patch was variable and hence not a subspecific character; in fact he could find no constant differences between the adult males of the two races, but found that females and immature males of *tricolora* differ from *ruticilla* in being "somewhat darker above, washed with duller green in immature dress."

The breeding range for *tricolora* given by Wetmore extends from Yukon, Mackenzie, Saskatchewan, central Ontario, and Quebec to Newfoundland, south to west-central Washington, northern Utah, Montana, northern Maine, New Brunswick, and Nova Scotia.

Both forms appear to migrate and winter together.

SETOPHAGA PICTA PICTA Swainson

NORTHERN PAINTED REDSTART

HABITS

One of the most attractive birds to be found in the mountain canyons of southern Arizona is this pretty little redstart, painted in striking contrasts of shining black, pure white, and brilliant red. It seems well aware of its beauty, as it flits about the rocky slopes and in the low undergrowth, constantly fanning its pretty tail, spreading its wings, and fluffing out its plumage to show off its colors in a charming display. We found it very common in the canyons of the Huachuca Mountains, from 5,000 up to 7,000 feet, but most abundant in the narrow, damp, shady parts near the mountain streams. H. W. Henshaw (1875) says: "It appears not to inhabit the high mountains nor the extreme lowlands, but to occupy an intermediate position, and to find the rocky hills covered with a sparse growth of oak most congenial to its habits." William Brewster (1882) reports that Frank Stephens found this redstart in the Chiricahua and the Santa Rita Mountains at an elevation of fully 7,000 feet; they occurred most frequently among pines in a canyon, where they had been seen in April.

Mrs. Bailey (1928) says: "Those seen by Major Goldman in the Burro Mountains [in New Mexico] in the fall were found 'among the oaks and pines on the northeast slope from 7,000 feet to the summit. One was working over the face of a cliff, its location and motions suggesting those of a Canyon Wren.' "

Josselyn Van Tyne (1929) added the painted redstart to the avifauna of Texas by finding it breeding in the Chisos Mountains, where a young bird was seen that was barely able to fly. "The species was seen only in the heavy pine and cedar forest at 7,000 [feet]. As they hunted insects in the pine trees their actions were often very Creeper-like, but with the additional spreading of the tail so characteristic of *S. ruticilla.*" Later (1937), he writes:

> Great fluctuations in the numbers of a species of bird in an apparently unchanged habitat are difficult to explain. The case of this species in the Chisos Mountains is especially interesting. In 1901 Bailey, Fuertes, and Oberholser saw no Painted Redstarts during their three weeks' exploration of these mountains. In 1928 Van Tyne and Gaige found the species fairly numerous at Boot Spring, and yet Van Tyne, Peet, and Jacot spent the whole of May at the same locality four years later without getting more than an unsatisfactory glimpse of one; and the Carnegie Museum party, in 1933 and 1935, did not record the species at all. On June 24, 1936, however, Tarleton Smith saw an adult male at the head of Blue Creek Canyon.

Spring.—The painted redstart belongs to a Mexican and Central American species. The northernmost of the two subspecies extends its breeding range across our border into southern New Mexico and Arizona. They arrive early in spring. H. S. Swarth (1904) noted the first arrivals in the Huachuca Mountains on March 15, "and a week or so later they were quite abundant. At all times rather a solitary bird, they are never to be seen in the mixed flocks of migrating warblers, but prefer rather to forage for themselves." During migration they are quite widely distributed over the mountains and down to the foothills. Those that Major Bendire saw near Tucson, and those that others have seen in April among the pines and oaks were probably migrating. Mrs. Bailey (1928) says that they arrive in New Mexico before the end of March. As the breeding season arrives, they settle down in their favorite canyons for the summer.

Nesting.—Eight years after the painted redstart was added to our avifauna the first nest was discovered by Herbert Brown, on June 6, 1880. A second nest was found by Frank Stephens in May of the next year, in a canyon between the two peaks of the Santa Rita Mountains. "It was under a small boulder in the side of a nearly perpendicular bank, which was but two or three feet high. The vicinity was heavily timbered with oak and sycamore."

This nest, with its three eggs was sent to Brewster (1882) who describes it as follows: "The nest, which is now before me, is large, flat and shallow. It is composed of bark, coarse fibres from weed-stalks, and fine, bleached grasses, the latter, with a few hairs, forming a simple lining. The cup measures 2.10 inches in width by 1 inch in depth; while the external diameter of the whole structure is rather more than 5 inches, and its depth about 1.50."

Since then quite a number of nests have been found in the Chiricahua and Huachuca Mountains, all somewhat similar to the above in location and in construction, differing widely in both respects from the nesting sites and the nests of the well-known eastern species, the American redstart. With one exception, all the nests of which we have any record have been placed on the ground, under a projecting rock, beneath the roots of a tree or shrub, or under a tuft of grass, and on the side of some steeply sloping bank or the rocky side of a mountain canyon, usually where grasses and ferns grow luxuriantly not far from a small stream or spring.

We found three painted redstart nests with eggs in the Huachucas on May 11, 16, and 28, 1922. Two of these were quite typical of the species, built on the ground on the sloping, rocky sides of canyons and well hidden under tufts of long grass; they were made of grasses and leaves and lined with finer grasses and hair. Both were found by watching the birds while they were building them; and neither was far from the little mountain stream that drained the canyon.

The third nest was most exceptional, I believe, in its location. We made our headquarters for the month of May in a little 2-room cabin that stood over the stream that flowed down through Ramsey Canyon. When we arrived on May 1, we were delighted to see that a pair of painted redstarts had begun building their nest in an ivy vine growing thickly over one side of our cabin. They were very tame and confiding and did not seem to be disturbed in the least by our frequent coming an going, but continued to build their nest and to lay and incubate the eggs. The nest was 10 feet above the ground in the thickest part of the vine, under the eaves; it was a bulky affair, made of the usual materials, as named. It held three eggs on May 16.

Eggs.—From 3 to 4 eggs, usually 4, make up the full set for the painted redstart. The eggs are ovate and slightly glossy. Those in the three sets in the Museum of Comparative Zoology are creamy white, very finely and delicately speckled with "chestnut," "auburn," or "russet," with almost imperceptible under markings of "deep brownish drab" or "light brownish drab." On some, the specklings are sharply defined and on others so faint as to hardly show. While the markings are concentrated at the large end, they do not seem to form a distinct wreath, as in so many warblers' eggs, but instead gradually dissipate toward the small end. The measurements of 50 eggs average 16.5 by 12.8 millimeters; the eggs showing the four extremes measure 17.6 by 13.2, 16.0 by 13.5, 14.5 by 12.7, and 16.8 by 11.7 millimeters (Harris).

Plumages.—The painted redstart is one of the few wood warblers in which the young bird assumes a practically adult plumage at the postjuvenal molt and in which the sexes are hardly distinguishable in any plumage.

In the juvenal plumage, the upper parts are sooty black and the lower parts are largely sooty grayish, passing into dull whitish on the center of the abdomen; the breast is spotted or streaked with sooty black; the wings and tail are black, as in the adult; the white patch on the wing and the white of the abdomen are usually tinged with yellowish or brownish buff.

The postjuvenal molt involves all the contour plumage and the wing coverts, but not the rest of the wings or the tail, and occurs mainly in July and August; I have seen the beginning of the molt as early as June 27, being well along on the head and back and only just beginning on the breast; on the other hand, I have seen a bird in full juvenal plumage as late as August 7, and another that had not quite completed the molt on October 31.

The complete postnuptial molt of adults occurs in July and August, but most birds that I have seen are in full, fresh plumage in August. There is little or no sexual difference in adults, though some females are slightly duller (less glossy) than males.

Food.—Nothing of consequence seems to have been published on the food of the painted redstart, but, as it is known to be an expert flycatcher, and as it has been seen frequently gleaning food from the trunks of trees and from the surfaces of rocks, it is evidently largely, if not wholly, insectivorous.

Behavior.—The actions of the painted redstart are strikingly reminiscent of the movements of the American redstart, to which of course it is closely related. It is one of our most active birds, almost constantly in motion, seldom remaining in one spot for more than a few seconds, and hardly to be exceeded in its nervous activity by the most restless of our little wrens. In spite of the striking colors that make it so conspicuous, it is not at all shy and seems to show no fear of humans; in fact it seems to court attention as it displays before us the beauties of its plumage, spreading its wings and tail to show the white areas and fluffing out its feathers to expose the brilliant carmine of its lower breast.

Swarth (1904) says that—

> he can be seen clambering over tree trunks or mossy rocks, turning now this way and now that, as if conscious and proud of his beautiful appearance even when engaged in the commonest duties of life, gathering insects for the young or material for the nest. Females, as well as males, strut about in the same ostentatious manner, for in color and appearance the sexes are absolutely indistinguishable; and even the dull colored juveniles adopt the same style as soon as they are able to fly. * * * Though feeding to some extent in the underbrush, and even on the ground and over the rocks, they do not stick closely to such places as do the Tolmie Warblers and Yellow-throats; nor on the other hand do they frequent the extreme tree tops and tips of the limbs as the Townsend, Hermit and other Warblers do, but preferring rather the medium between the two extremes, they can be seen clambering about the sides of the tree trunks and over the larger limbs, examining the crevices and interstices in the bark in search of food, and occasionally flying out a short distance after some passing insect.

Mrs. Bailey (1928) writes:

> In catching insects they often dropped through the air or made downward swoops in conventional Redstart and Flycatcher-manner, and once one dropped about twenty feet to catch on a hanging rope and then on a vine that swung with it prettily; but in the main they hunted in the sycamore and live oak tops and markedly and perhaps preferably on the great slanting trunks of the live oaks where the crevices of the bark seemed to supply a ready feast. Even in the mesquites, a Painted Redstart was seen flying from one trunk to another. On the oaks, when the long black and white fan tail was outspread against the bark the suggestion was of a museum specimen, a pinned-out gorgeous butterfly. Another interesting pose of the Redstart's suggesting a close scrutiny for insects was a forward tilt of the body with the black crest raised enquiringly.

Voice.—Swarth (1904) says: "A call note is uttered at frequent intervals, not unlike the peep of a young chicken, and occasionally the short, low song of the male can be heard. Though this is usually given utterance to between intervals of feeding, I have once or twice, usually in the early morning, seen the male ascend to the top of a tall tree, and from the tip of some dead limb repeat his song, sometimes for half an hour before descending."

According to Mrs. Bailey (1923), "their song begins with an ordinary warbler *whee-tee*, *whee-tee*, but ends unusually, both call and song having individual rich contralto quality."

Dr. Alexander F. Skutch contributes the following note on the habits of the Guatemalan subspecies:

"I first made the acquaintance of the painted redstart on the Sierra de Tecpán in west-central Guatemala, where I studied the bird life during the year 1933. I had been on the Sierra many months before I saw a painted redstart. It was keeping company with a Kaup's redstart (*Myioborus miniatus*) in the lighter oak woods on the lower part of the mountain, at an altitude of about 7,500 feet. These two warblers are rather similar in color pattern; but the hues of the painted redstart were even more brilliant than those of its companion. The methods of foraging of the two birds formed an interesting contrast. The painted redstart sought its food chiefly on the bark of the trunks, branches, and coarser twigs; the other caught its insects on the finer twigs, the foliage, and in the air. The painted redstart worked along the larger branches of the oak trees, often hung head downward from their sides while it peered beneath them, and not infrequently clung in an inverted position while it plucked some insect from the underside of a horizontal limb. It also ascended erect trunks, to which it clung with perfect ease, and moved upward by a series of quick, irregular, jumping flights. An allied woodhewer accompanied the two redstarts, and at one time it hunted on the same trunk with the painted redstart. It was instructive to compare their modes of procedure. The woodhewer worked up the tree in its slow, methodical fashion, and probably found every insect and spider that lurked in the crevices of the bark over which it passed. The redstart ascended in a rapid, impulsive manner, touching the bark only here and there, taking only a fraction of the time consumed by the woodhewer in covering the same distance, but without much doubt missing a number of morsels which the patient brown bird would have discovered. Sometimes, too, the painted redstart hunted among the foliage, but not nearly so much as on the bark.

"I must have watched the redstarts for more than an hour, rarely having seen two more attractive birds in the same tree; and they kept together the whole time. The painted redstart had been molting; its two outermost tail feathers were considerably shorter than the others and served as a mark of recognition. Two hours after I had left these birds, I returned to the part of the woods where I had first encountered them, and found the two still together. Since a Kaup's redstart was almost never to be found in company with another of its own kind at this season—it was then the first of August—I thought it strange that it should associate so intimately with a member of another species of rather similar habits. After this date, the painted redstarts became more numerous on the Sierra de Tecpán; and not infrequently I saw one of each of these two species in a mixed flock of small birds. The painted redstart appeared to be just as intolerant of its own kind at that season as the Kaup's redstart; but the two species got along very well together.

"On the same morning when I met my first painted redstart, I found a second bird in perfect plumage who was singing. His loud, ringing *weecher weecher weecher* was wonderfully rich and mellow, surpassing in fullness of tone even the *ch'ree ch'ree ch'ree* of Kaup's redstart.

"These two lovely redstarts are found separately more often than together. The painted redstart, which ranges much farther to the north, prefers dry, open woodlands of pine and oak, and is very much at home in some of the dry interior valleys in the highlands of Guatemala, where one will look in vain for Kaup's redstart. The latter lives in heavier and more humid forests where the other rarely ventures; but in intermediate types of woodland the two species may meet. In the latter part of the rainy season, the painted redstarts seemed to wander about a good deal; and I frequently saw them on parts of the Sierra de Tecpán where I am sure they had not been during the breeding season. All did not forage so exclusively upon the bark as the first which I met; but usually they devoted considerable attention to this source of food. At times they wove among the branches and darted out into the air with a sprightliness almost equal to that of Kaup's redstart, or the American redstart. Like their relatives, they often kept their tail spread as they hunted, revealing its contrasting areas of black and white, and adding greatly to their appearance.

"Later in the year, after the American redstarts came down from the north, I once encountered a single member of each of the three species foraging together in a little grove on the plateau near Tecpán. The American redstart was a male in perfect plumage. Since the sexes of the other two species are alike, it was impossible to decide whether they were male or female; but each was an excellent representative of its own kind. It was indeed difficult to judge which of the three was the most beautiful; but the painted redstart, with its deep, contrasting colors, most took my eye."

C. Russell Mason contributes the following remarkable record of the winter wandering of the far-western species:

"On October 18, 1947, while casually birding at Marblehead Neck, Mass., Mrs. Heyliger deWindt, of Boston, and Mrs. David H. Searle, of Marblehead, were attracted to a small bird, strikingly marked in black, white, and bright red, that was actively feeding in a tree above them. It was a species entirely new to them, and examination of their eastern bird books on returning home failed to place it. The bird was watched intermittently in the same neighborhood over a 5-hour period, and every detail of color and marking was noted. A call to the executive director of the Massachusetts Audubon Society and a further check on the bird by the discoverers and by Herbert Caswell, of the Essex County Ornithological Club, Salem, identified the visitor as a painted redstart. The bird was still present in the same area the following day, when it was observed by Ludlow Griscom, of the Museum of Comparative Zoology at Harvard University, and many parties of bird enthusiasts, including fifty members of the Massachusetts Audubon Society on a regularly scheduled field trip.

"In the Audubon party, a graduate student at Harvard who was equipped with a motion picture camera having a telephoto lens secured color motion pictures of this western redstart as it posed obligingly for minutes between its active feeding and preening periods. The bird was last seen in midafternoon of that day.

"So far as can be determined by the records, this is the first occurrence of the painted redstart in the United States outside of its usual range, which includes Arizona, New Mexico, and the Chisos Mountains of western Texas, except for somewhat recent reports of the species from southern California. How the bird happened to reach New England must remain a mystery, though other western and southwestern species have been reported in increasing numbers in recent years. The possibility of its being an escaped cage bird seems remote, since birds with food habits of the warblers are seldom, if ever, caged, even by cage-bird enthusiasts living in Mexico and Cuba."

DISTRIBUTION

Range.—Southeastern Arizona, southwestern New Mexico, western Texas, central Nuevo León, and central Tamaulipas; south through the Mexican highlands to Guatemala, El Salvador, and central Honduras.

Breeding range.—Only the northern painted redstart (*Setophaga picta picta*) reaches our borders. It breeds **north** to southeastern Arizona (Santa Catalina Mountains, Seven Mile Canyon, Fort Apache, and Bear Canyon); southwestern New Mexico (Alma, Cooney, and Monticello); and western Texas (Chisos Mountains). **East** to western Texas (Chisos Mountains); through the Sierra Madre Oriental to Hidalgo (probably La Placenta); and probably Veracruz. **South** to probably Veracruz; and Oaxaca. **West** to Oaxaca; Guerrero; and southeastern Arizona (Santa Catalina Mountains). It has been seen or collected during the nesting season in north-central Arizona (Wheeler Canyon, near Flagstaff, and the Mogollon Plateau); southwestern Utah (Zion National Park); and northwestern New Mexico (Zuni Mountains).

Winter range.—It winters in the southern part of its breeding range north to central Sonora (Huerachi); central western Chihuahua (Guanopa); central Nuevo León (Mesa del Chipinque); and central Tamaulipas (Río Martínez and Victoria); casually north to southern Arizona (Pena Blanca Canyon).

Casual in southern California (Altadena); accidental in Massachusetts (Marblehead Neck).

Early dates of spring arrival are: New Mexico—Anthony, March 25. Arizona—Huachuca Mountains, March 14. Utah—Zion National Park, April 26 (only Utah record).

Late dates of fall departure are: New Mexico—San Luis Mountains, September 29. Arizona—Oracle, October 17.

Egg dates.—Arizona: 18 records, April 28 to July 2; 9 records, May 17 to June 7, indicating the height of the season.

New Mexico: 2 records, March 30 and May 30 (Harris).

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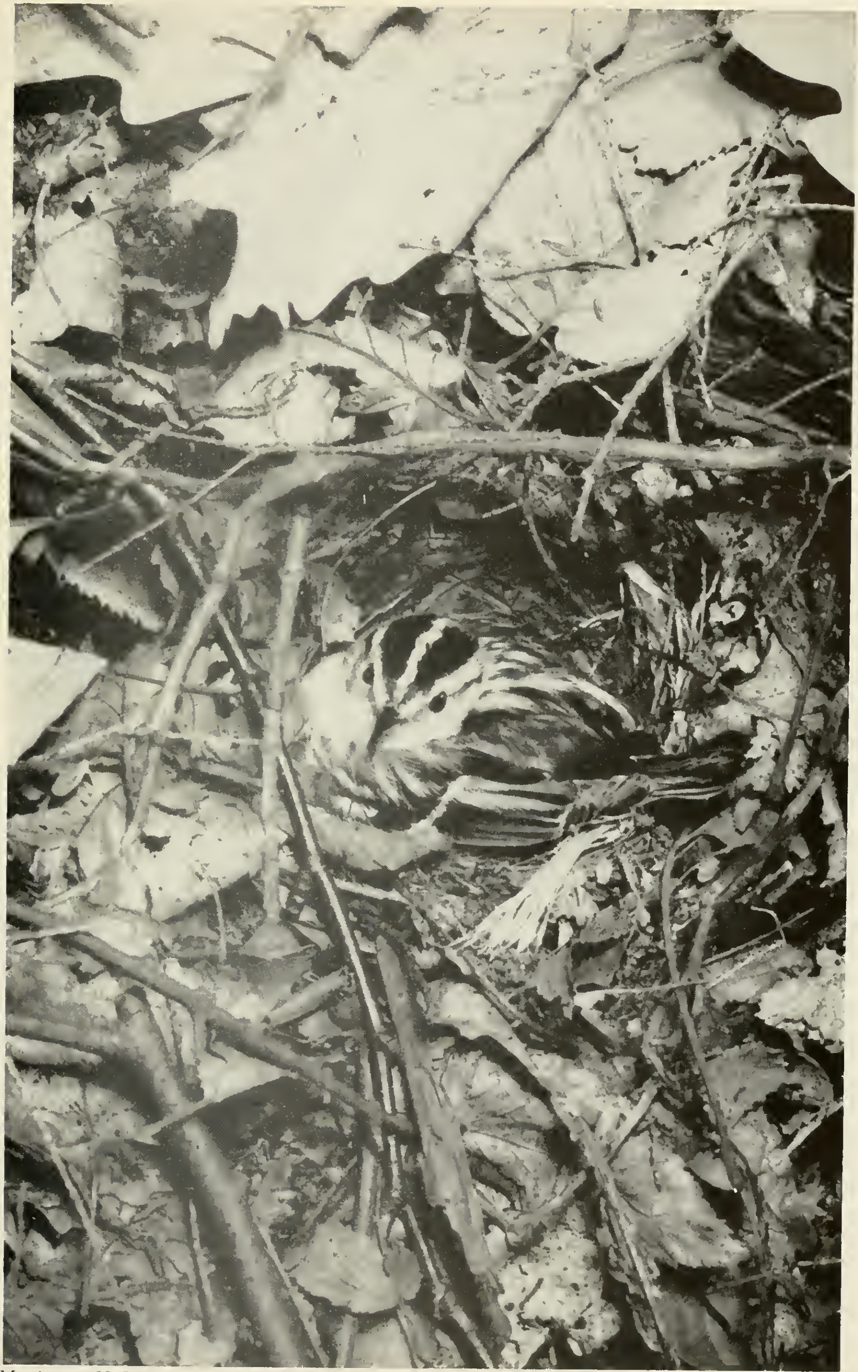
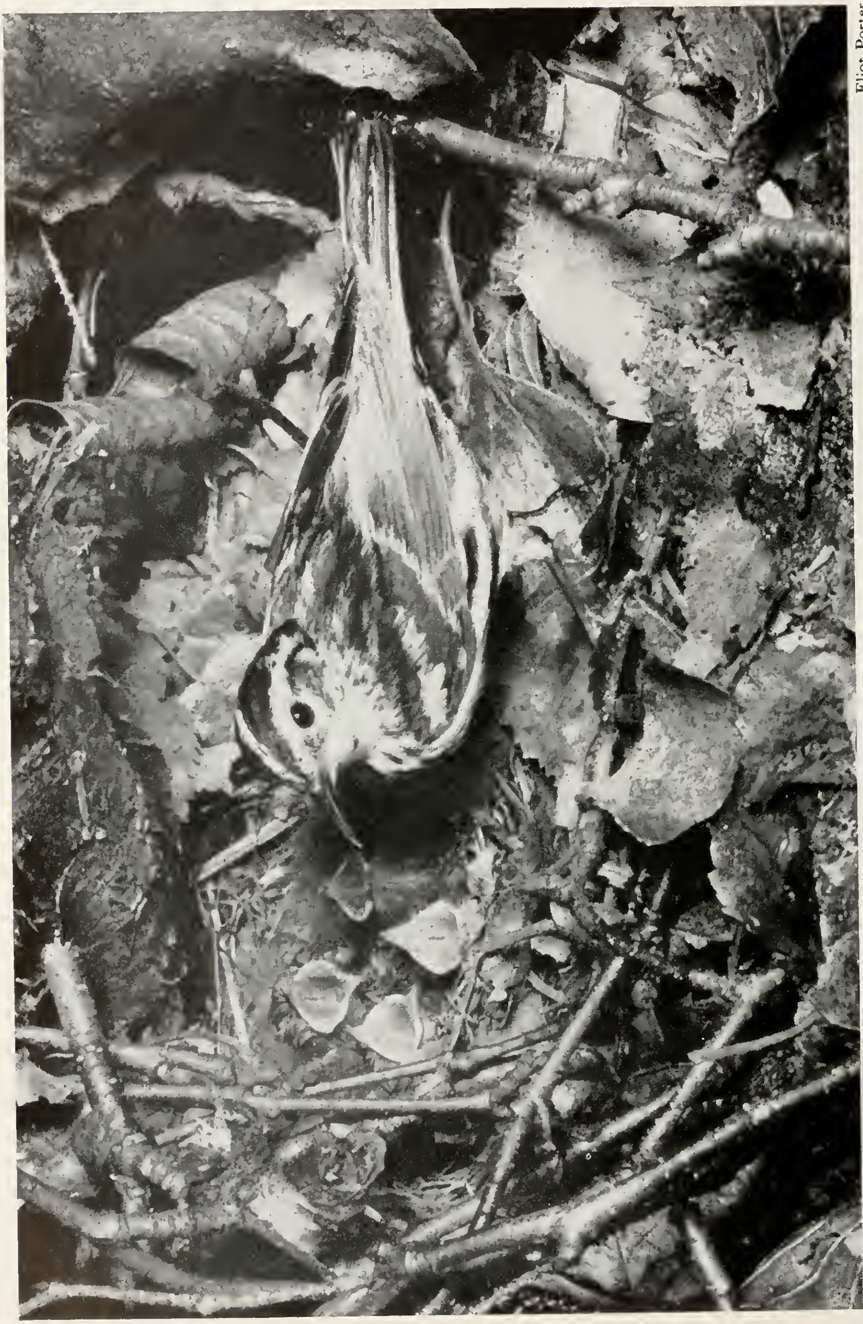


Morristown, N. J. R. T. Peterson

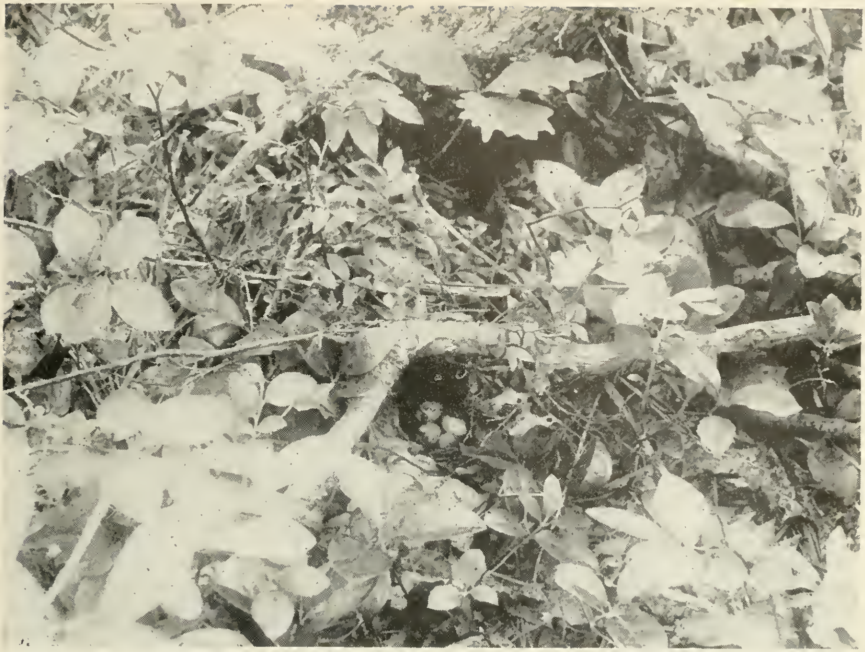
BLACK-AND-WHITE WARBLER



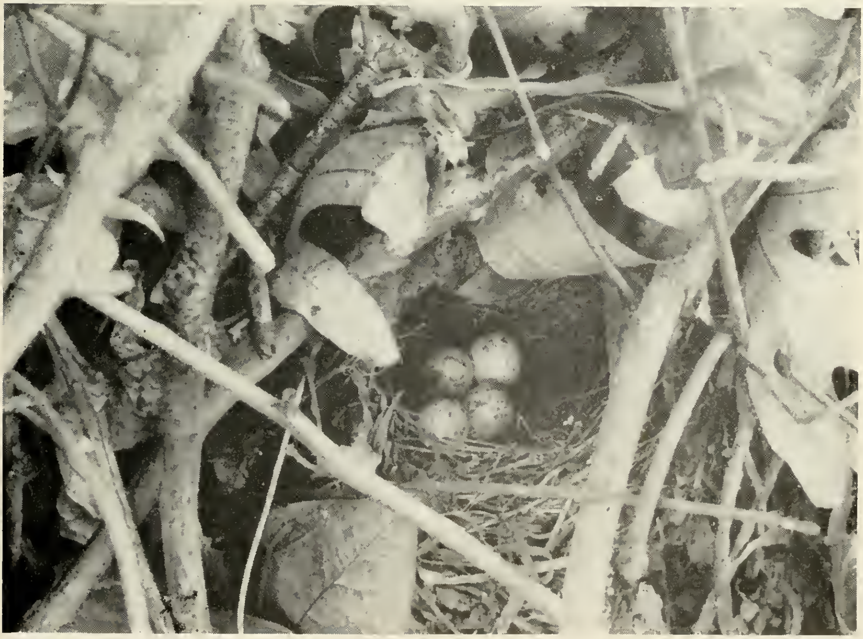
Eliot Porter

BLACK-AND-WHITE WARBLER, MALE

Maine, June 29, 1940

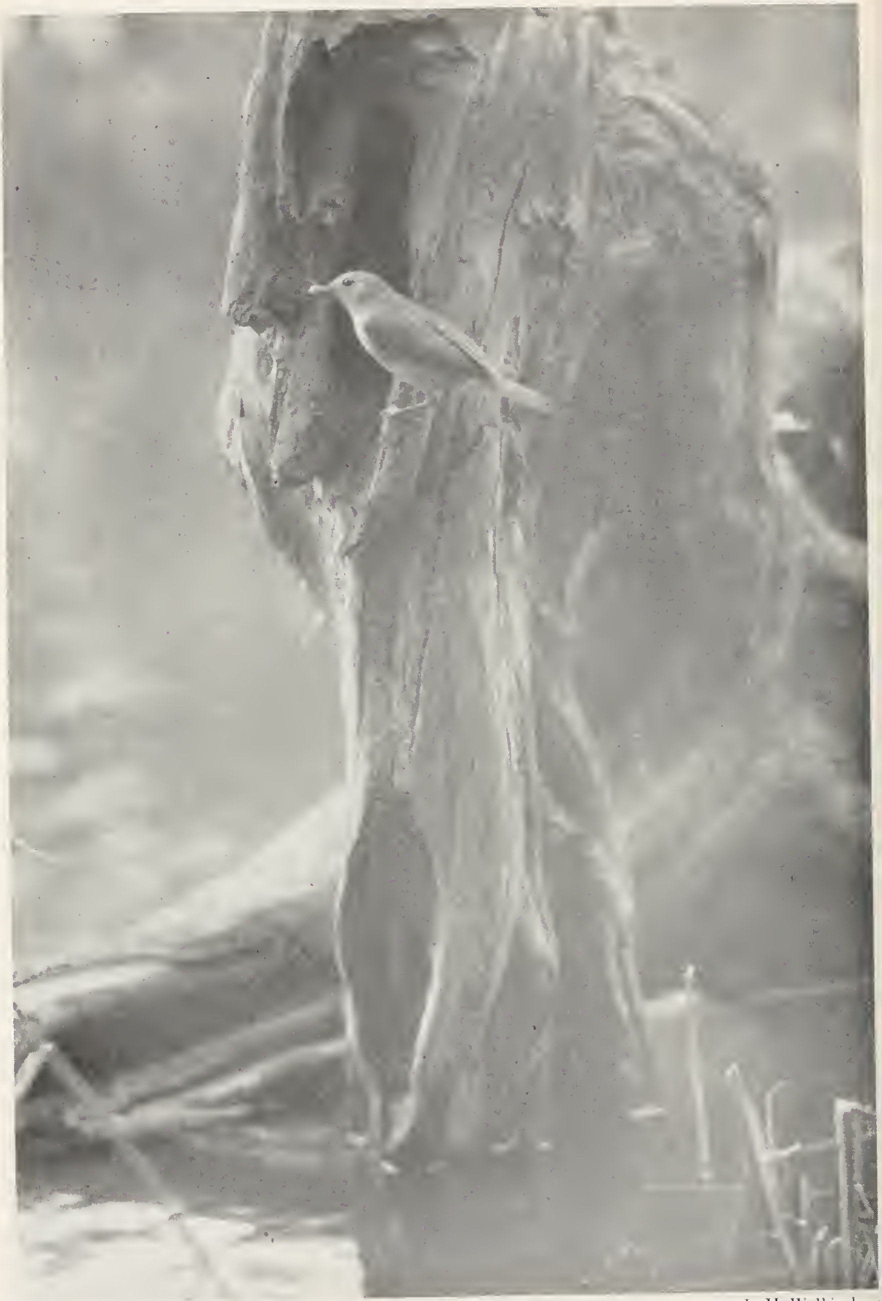


Dennis, Mass., June 17, 1921 A. C. Bent



Johnson City, Tenn., May 10, 1942 B. P. Tyler

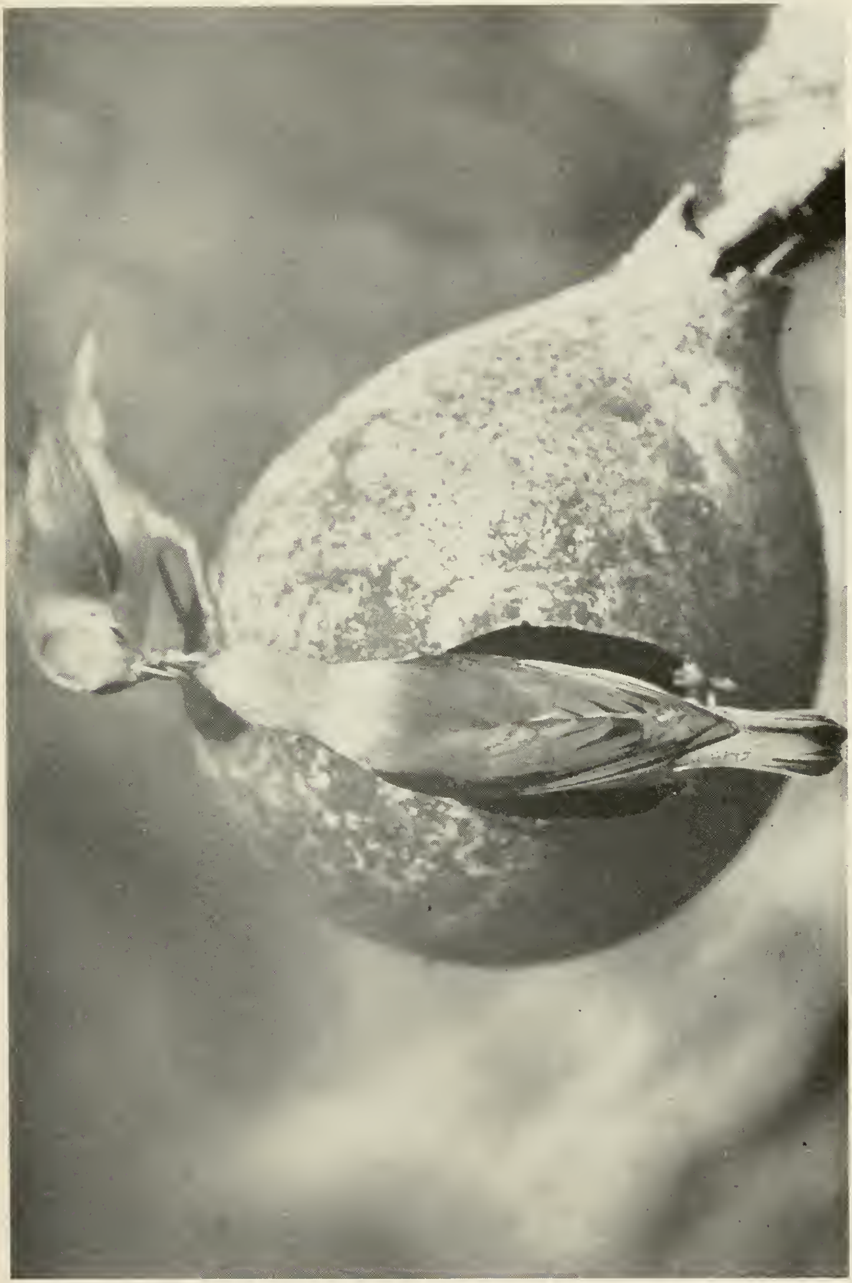
NESTS OF BLACK-AND-WHITE WARBLER



Reelfoot Lake, Tenn., July 9, 1940

L. H. Walkinshaw

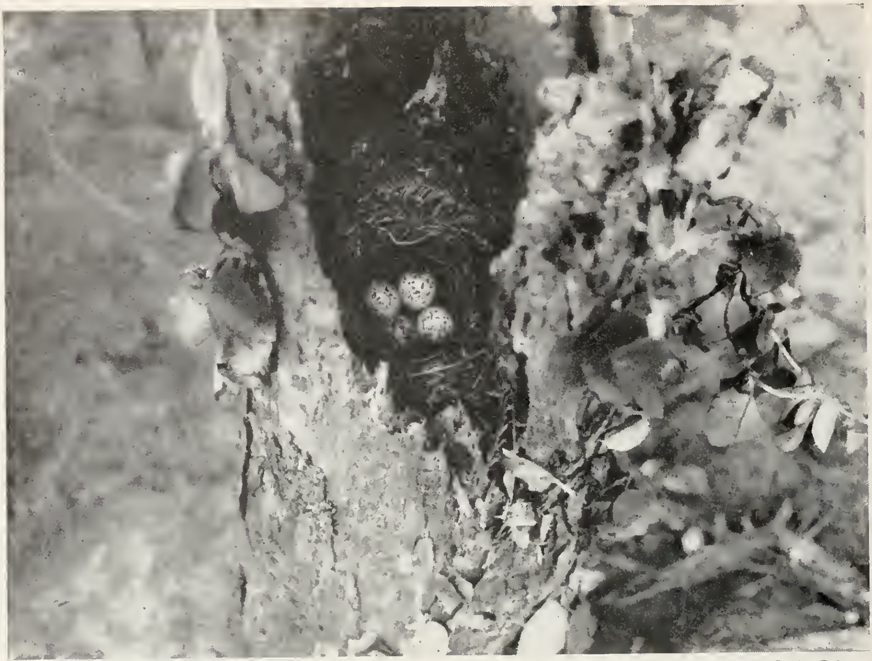
PROTHONOTARY WARBLER



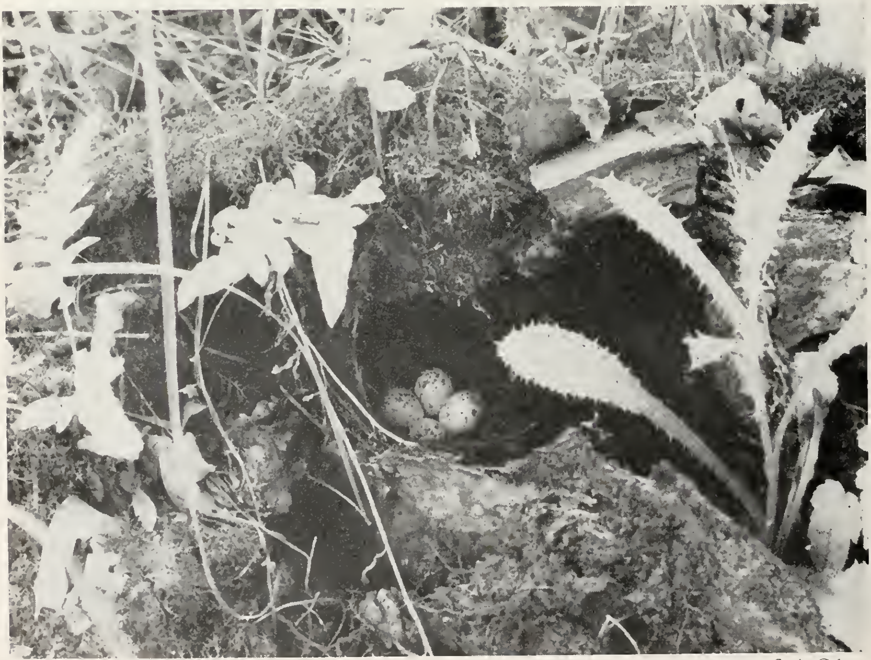
S. A. Grimes

Duval County, Fla., May 8, 1935

PAIR OF PROTHONOTARY WARBLERS

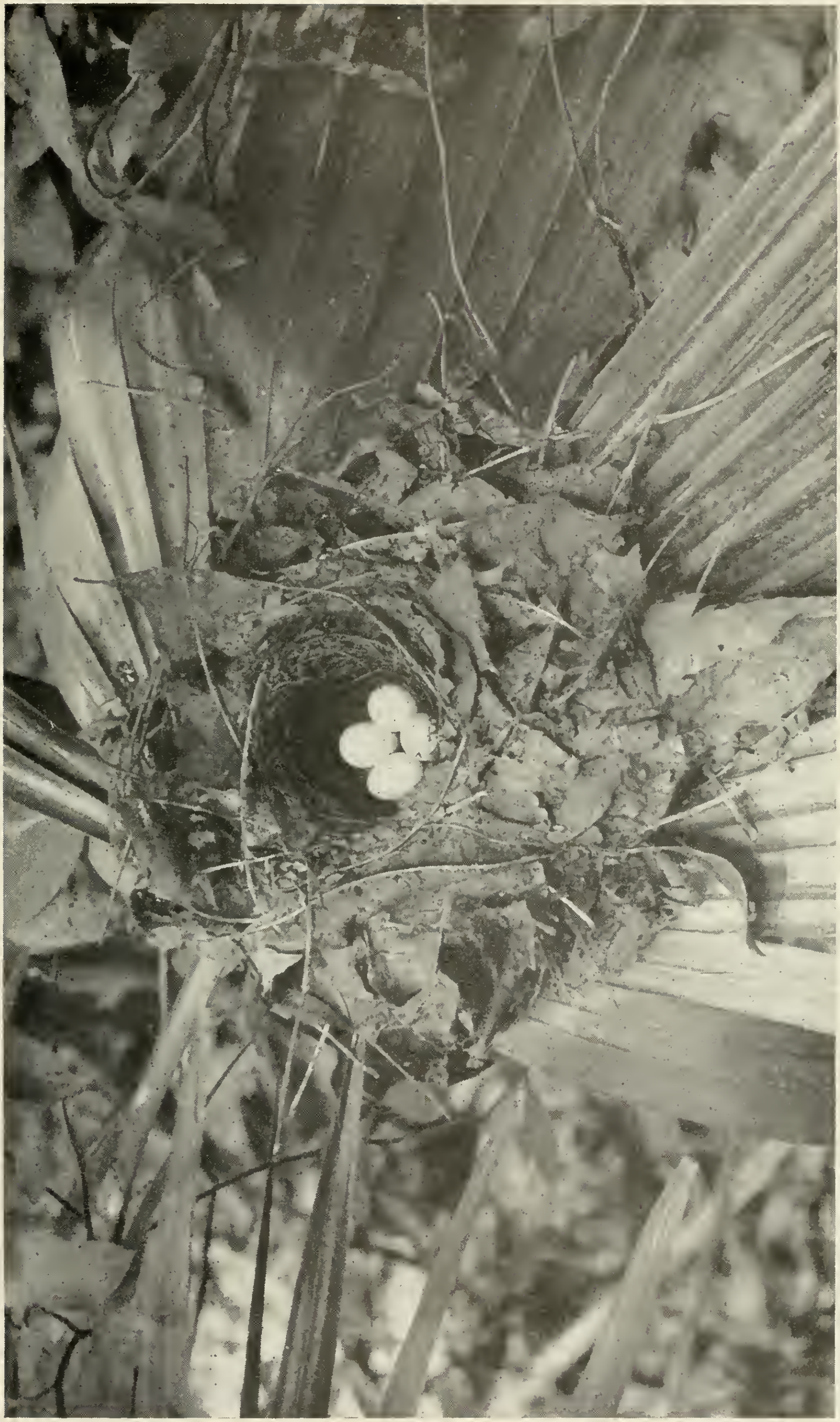


Duval County, Fla., May 22, 1931 S. A. Grimes



Duval County, Fla., June 14, 1935 S. A. Grimes

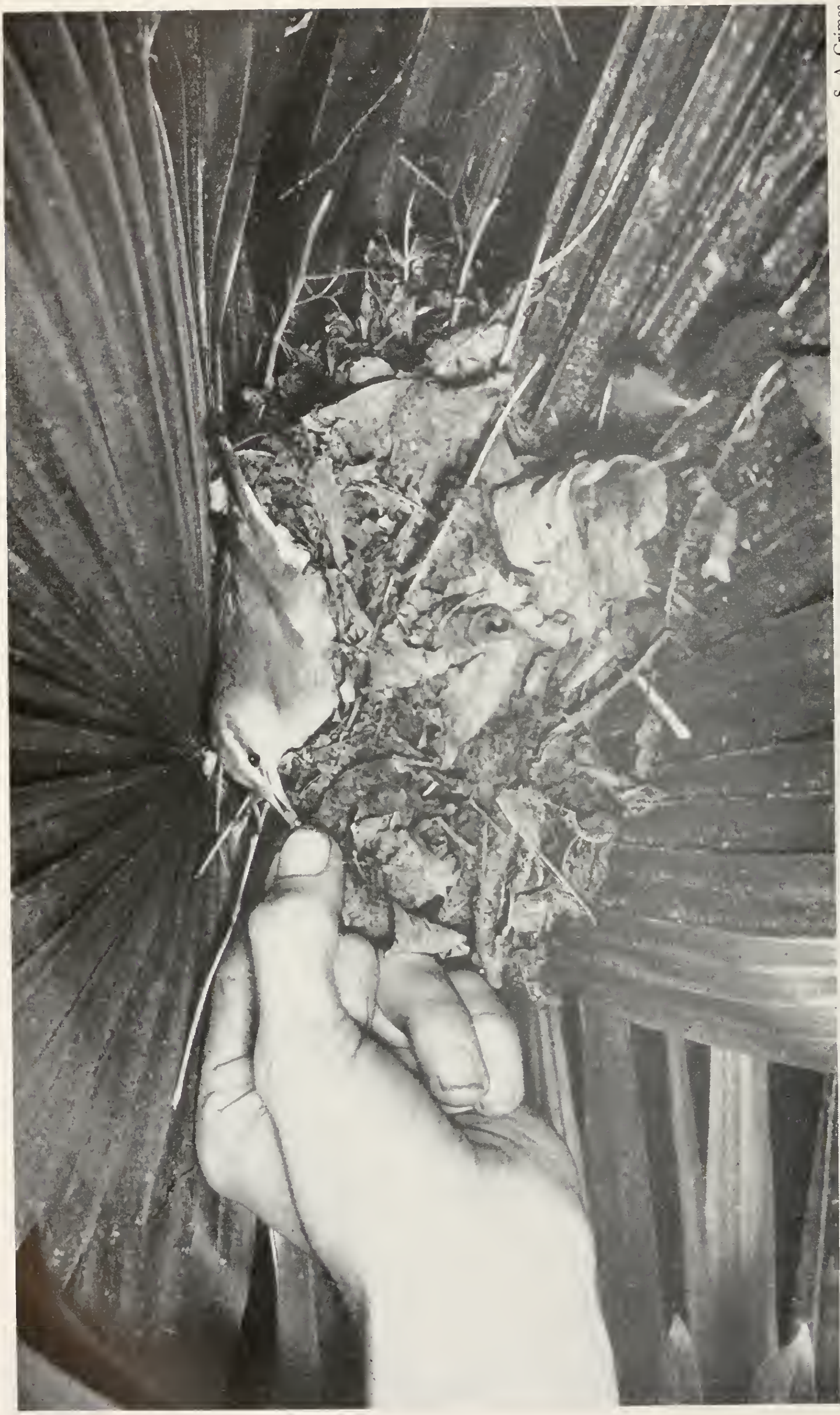
NESTS OF PROTHONOTARY WARBLER



Duval County, Fla., May 13, 1936

S. A. Grimes

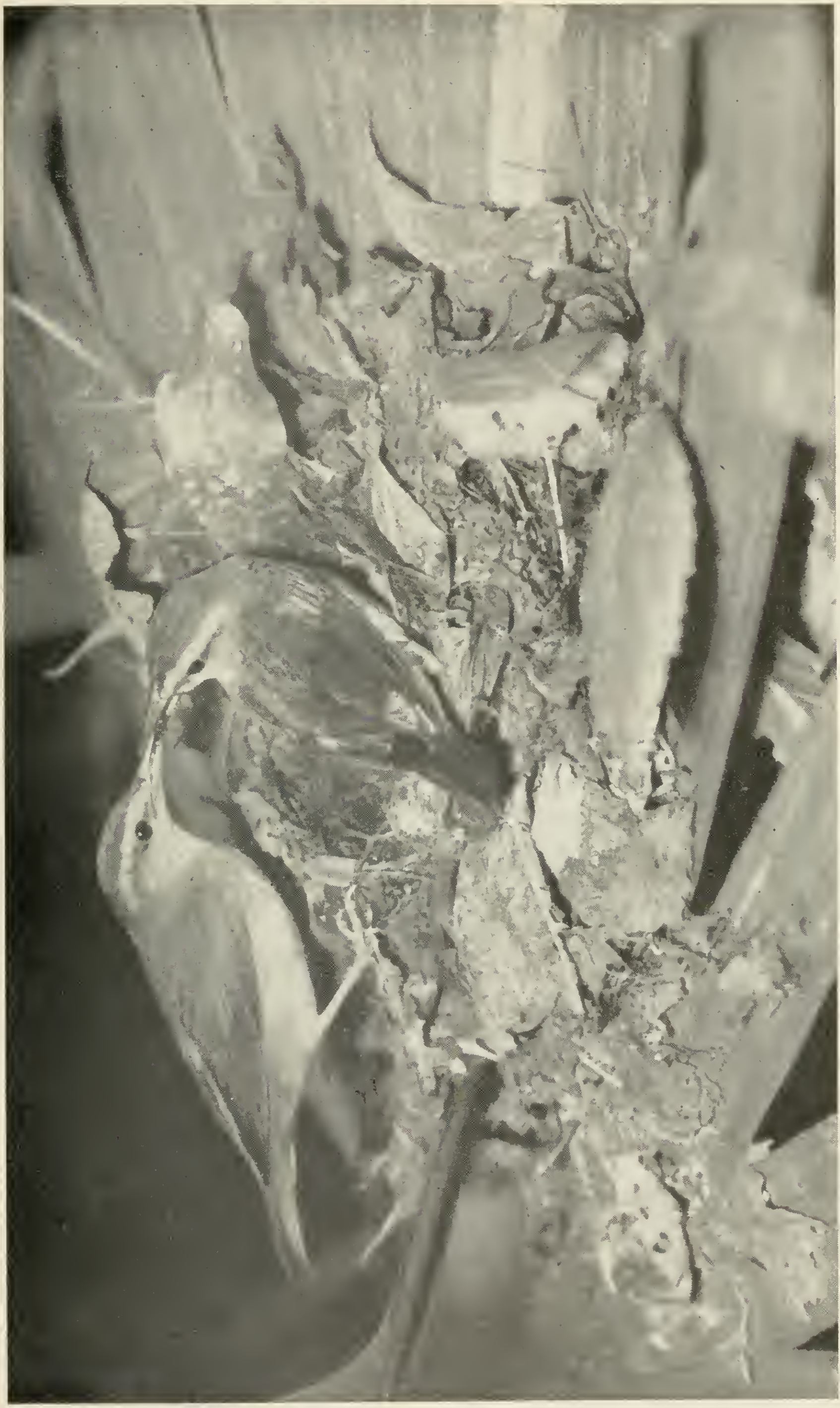
NEST OF SWAINSON'S WARBLER



S. A. Grimes

SWAINSON'S WARBLER

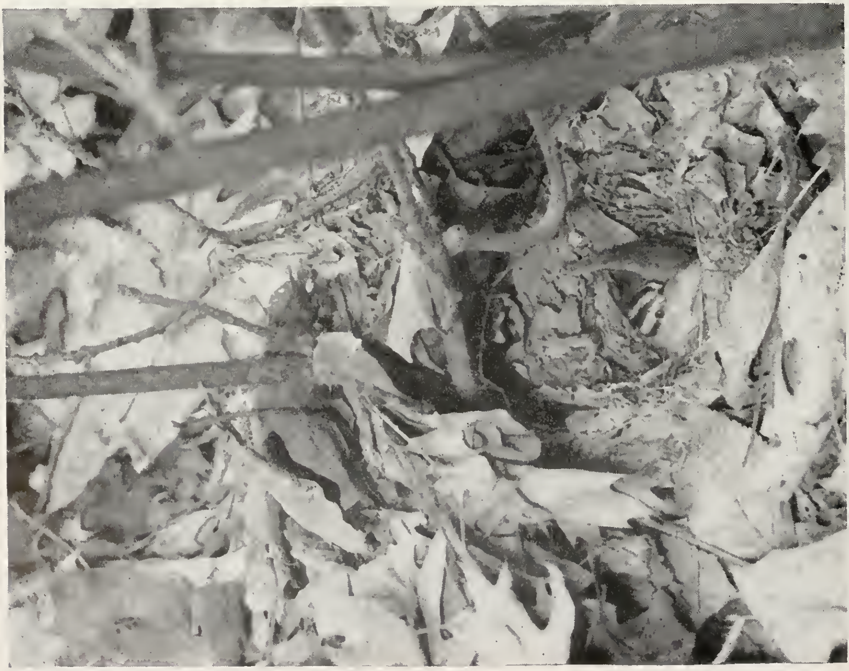
Duval County, Fla., May 1936



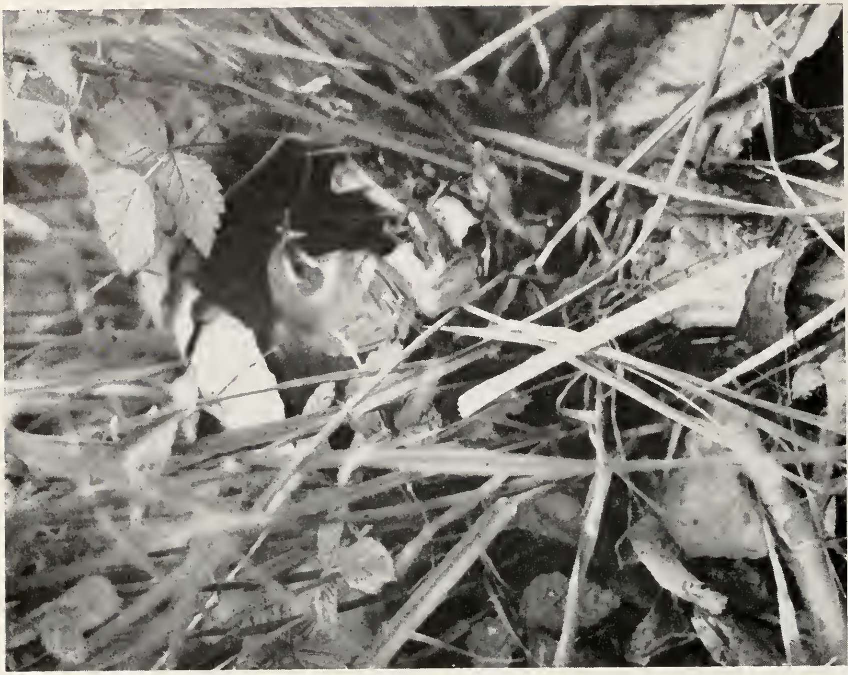
S. A. Grimes

PAIR OF SWAINSON'S WARBLERS

Duval County, Fla., May 1941



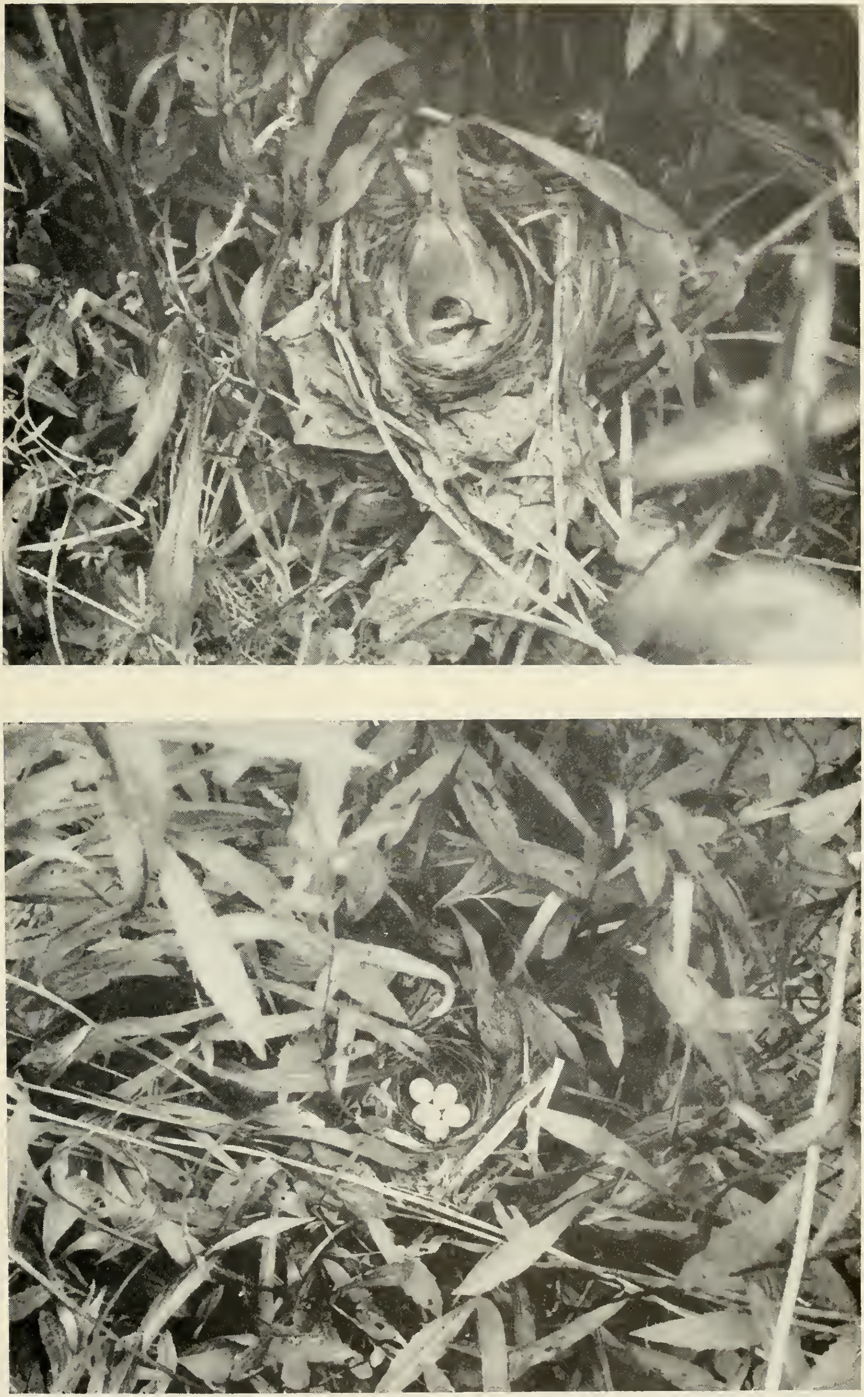
Allen Frost



L. H. Walkinshaw

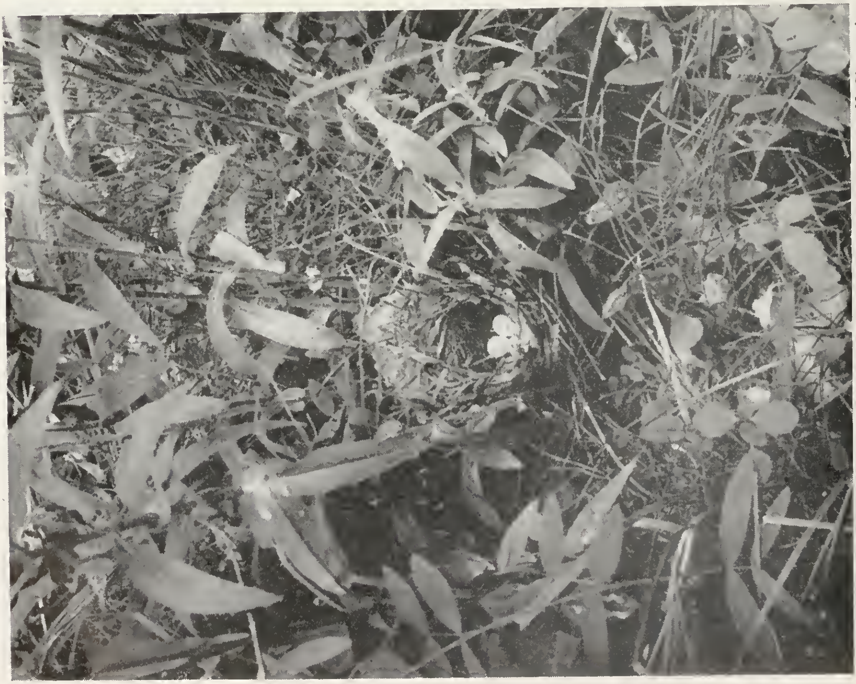
Calhoun County, Mich., June 9, 1937

WORM-EATING WARBLER (LEFT) AND GOLDEN-WINGED WARBLER (RIGHT)

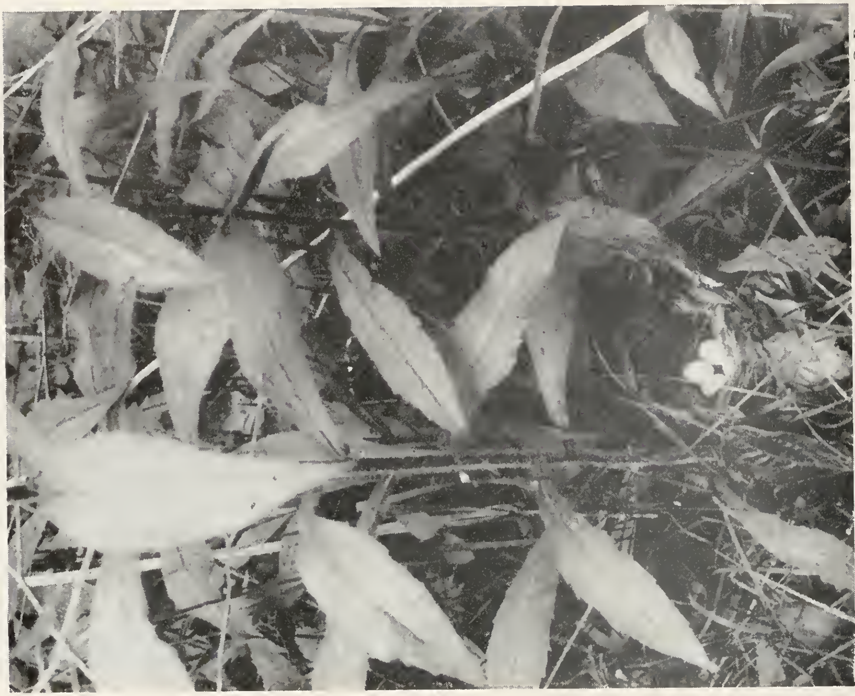


Near Branchport, N. Y. C. F. Stone

Golden-Winged Warbler and Nest

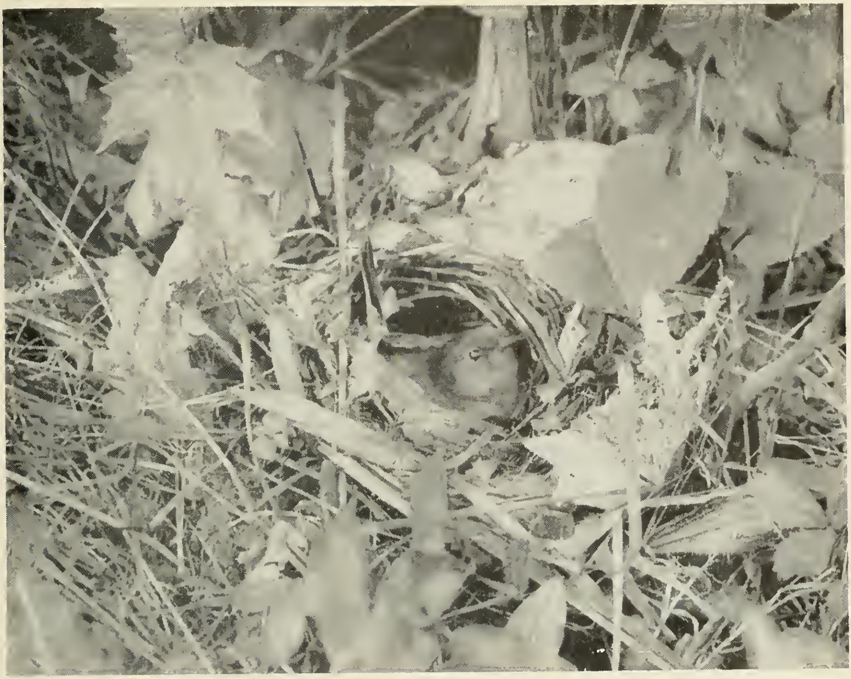


Near Omaha, Nebr., June 8, 1901 F. H. Shoemaker

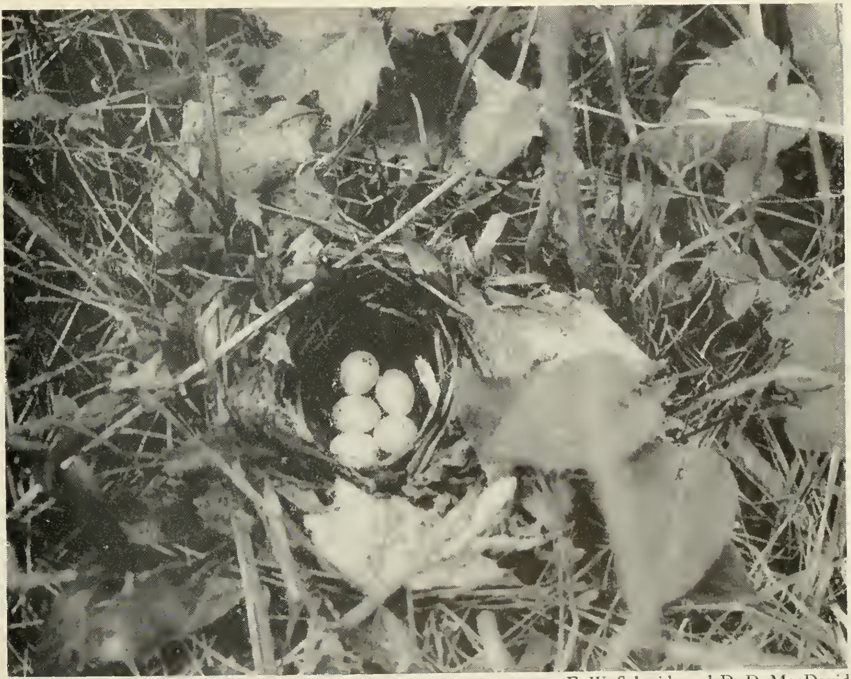


Hadlyme, Conn., June 1, 1934 A. C. Bent

NESTS OF BLUE-WINGED WARBLER



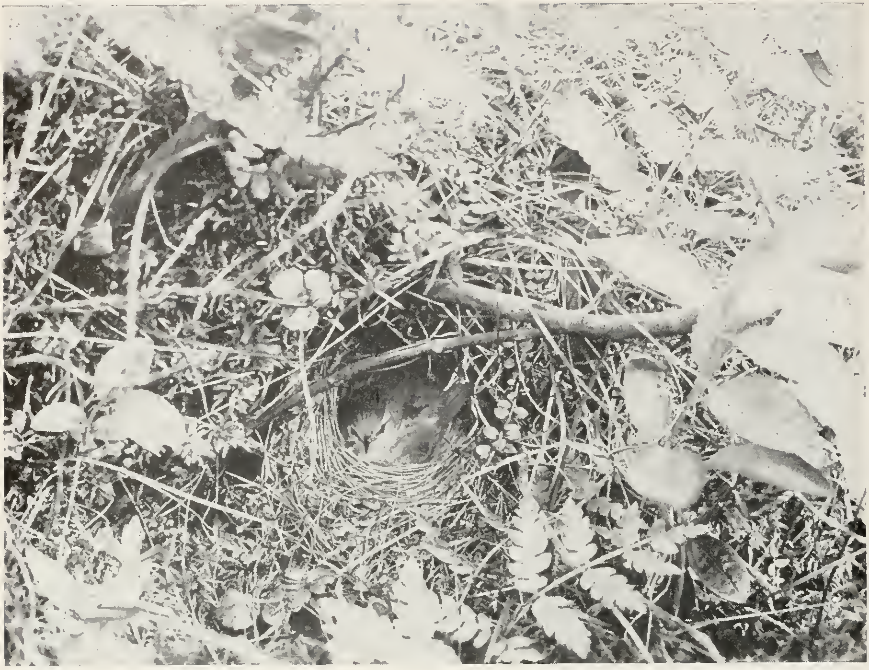
New Britain, Conn., June 5, 1932

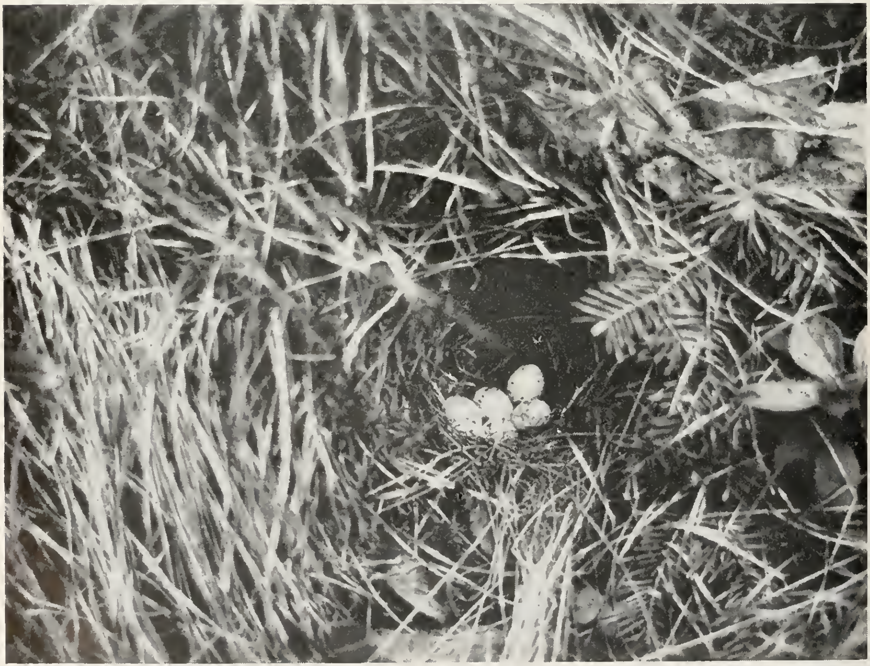


New Britain, Conn., May 27, 1932

E. W. Schmidt and D. D. MacDavid

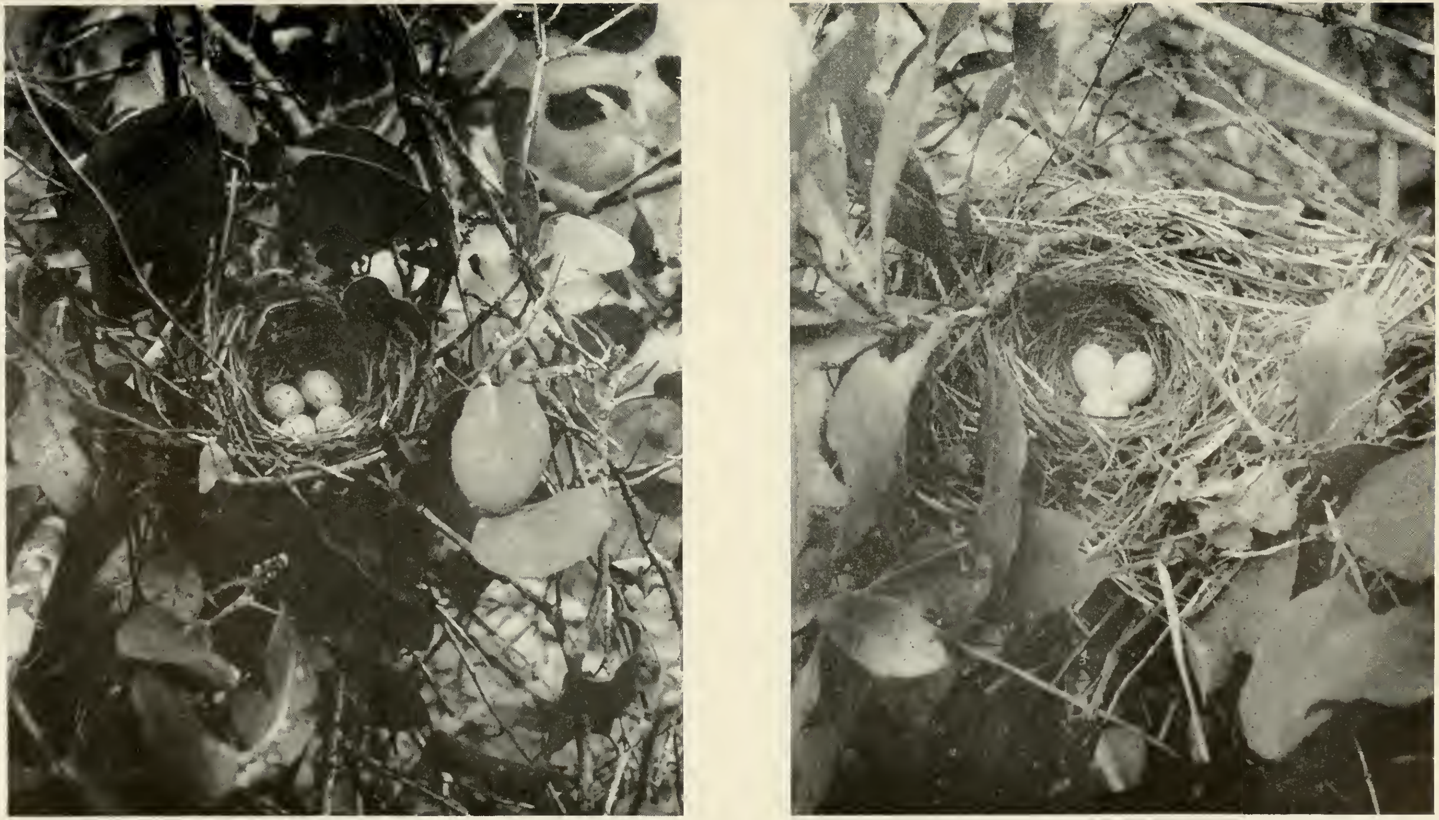
BLUE-WINGED WARBLER AND NEST





Tabusintac, New Brunswick B. S. Bowdish

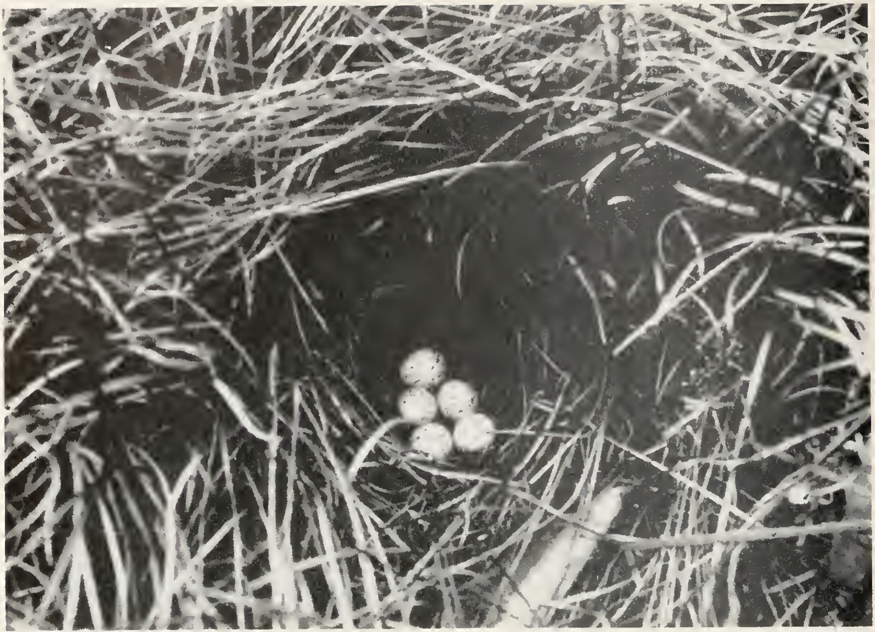
TENNESSEE WARBLER AND NEST



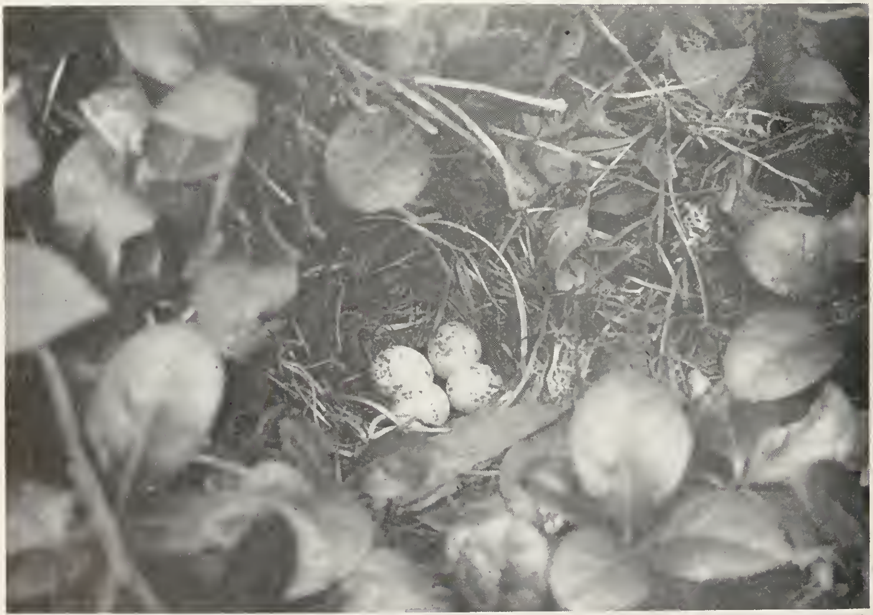
Santa Catalina Island, Calif., April 16, 1939

J. S. Rowley

NESTS OF DUSKY ORANGE-CROWNED WARBLER

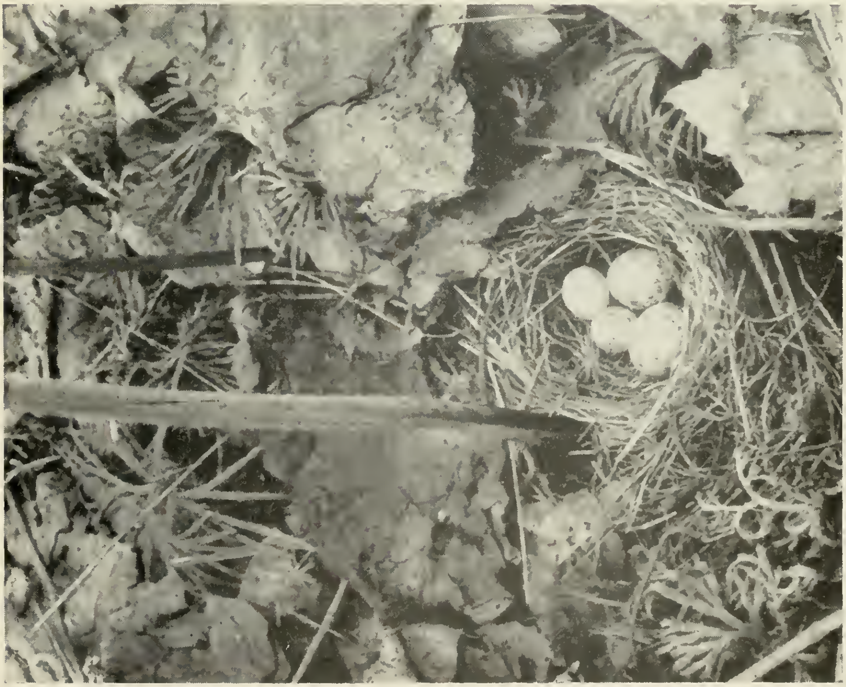


Yates County, N. Y. C. F. Stone



Tabusintac, New Brunswick B. S. Bowdish

NESTS OF EASTERN NASHVILLE WARBLER

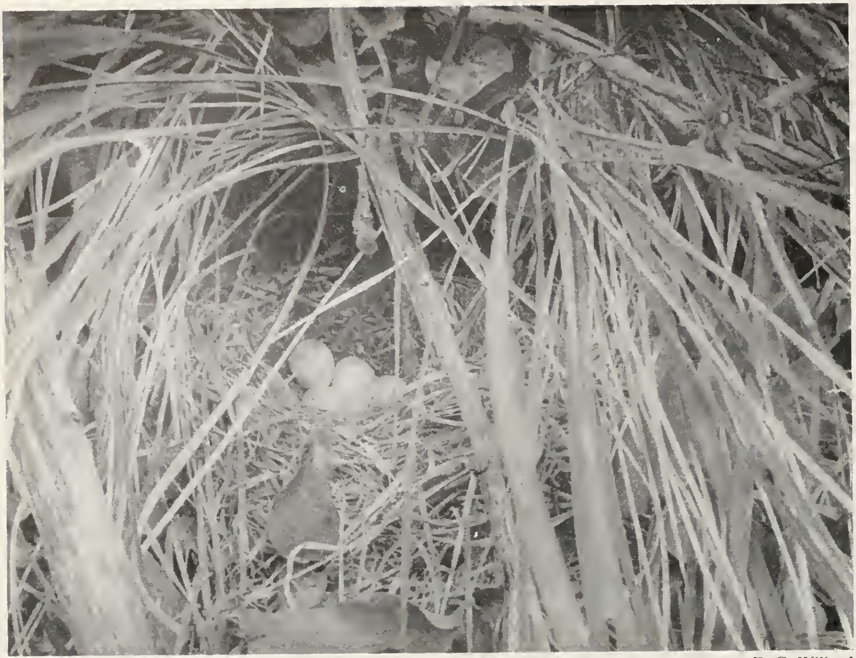


Saint Dorothee, Quebec, June 4, 1943 W. J. Brown

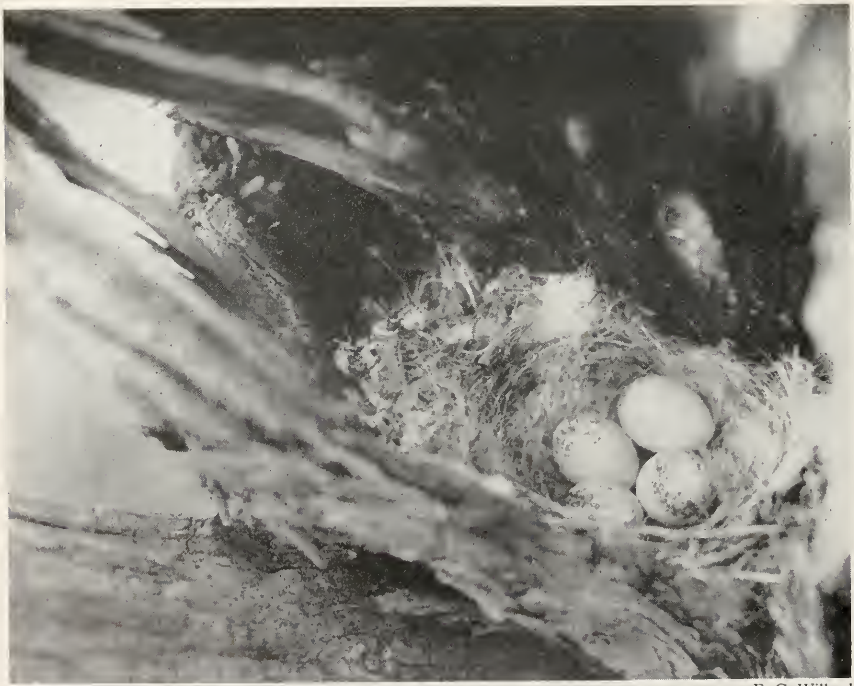
Tabusintac, New Brunswick B. S. Bowdish

NESTS OF EASTERN NASHVILLE WARBLER

(Note two cowbird eggs in nest on left)

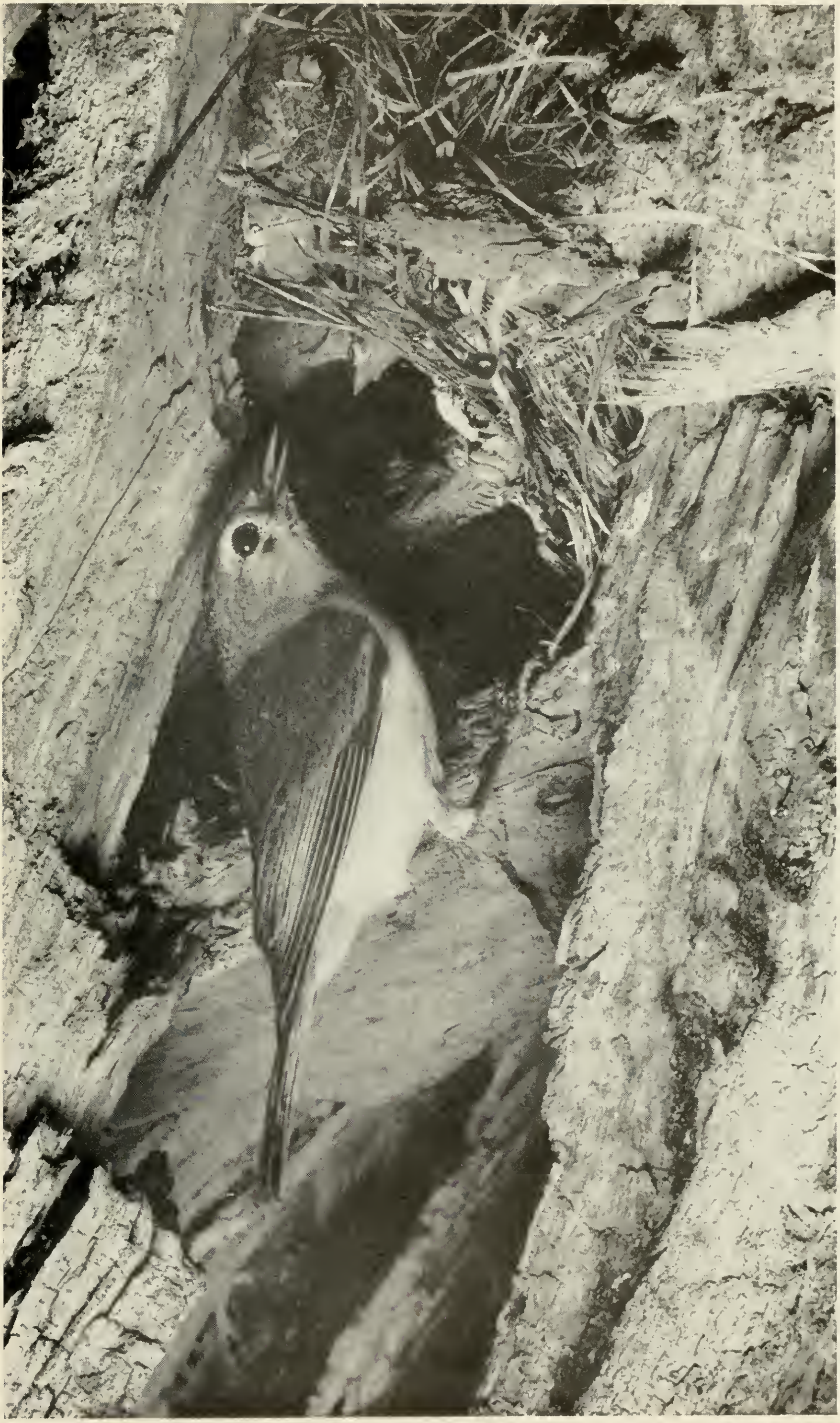


Huachuca Mountains, Ariz. F. C. Willard



Pima County, Ariz. F. C. Willard

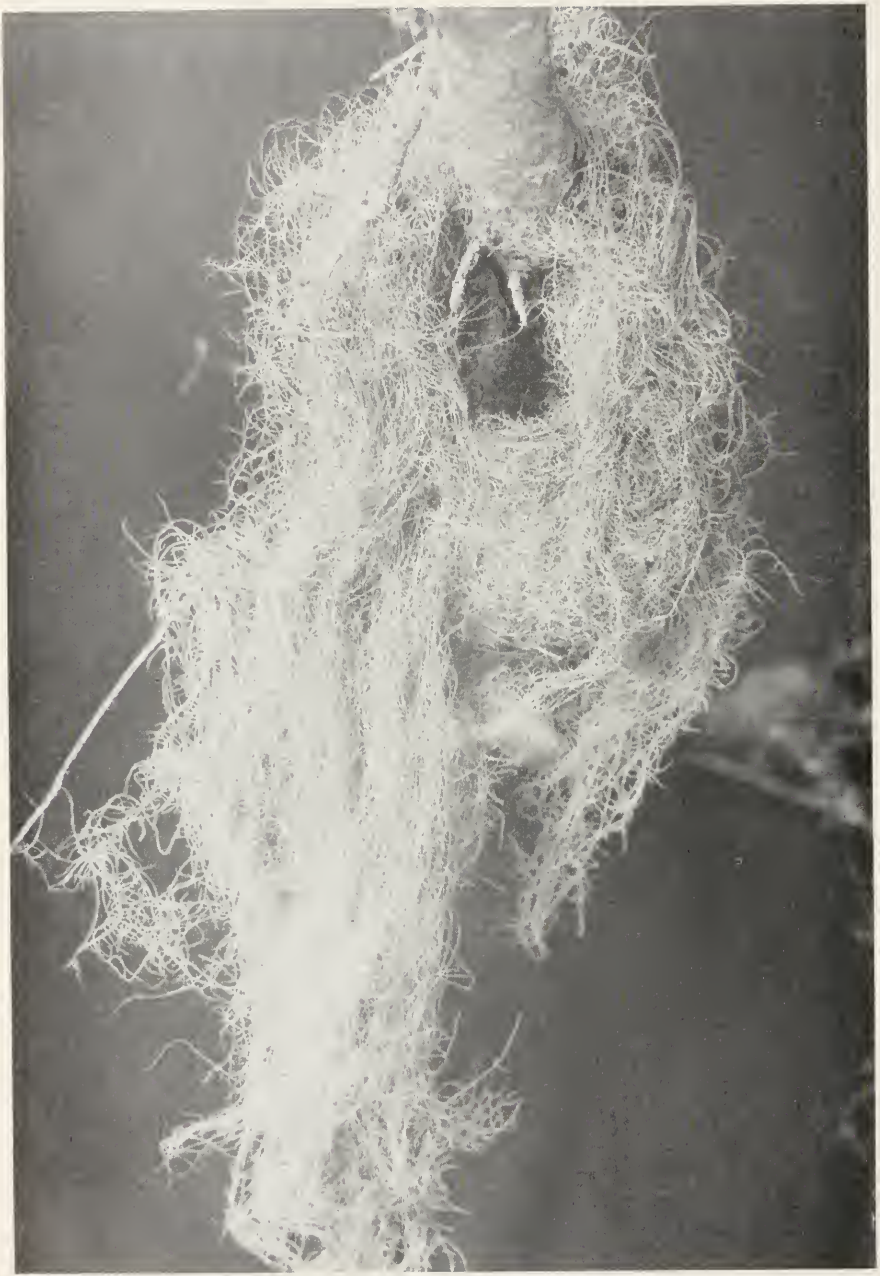
NESTS OF VIRGINIA'S WARBLER (UPPER) AND LUCY'S WARBLER (LOWER)



Eliot Porter

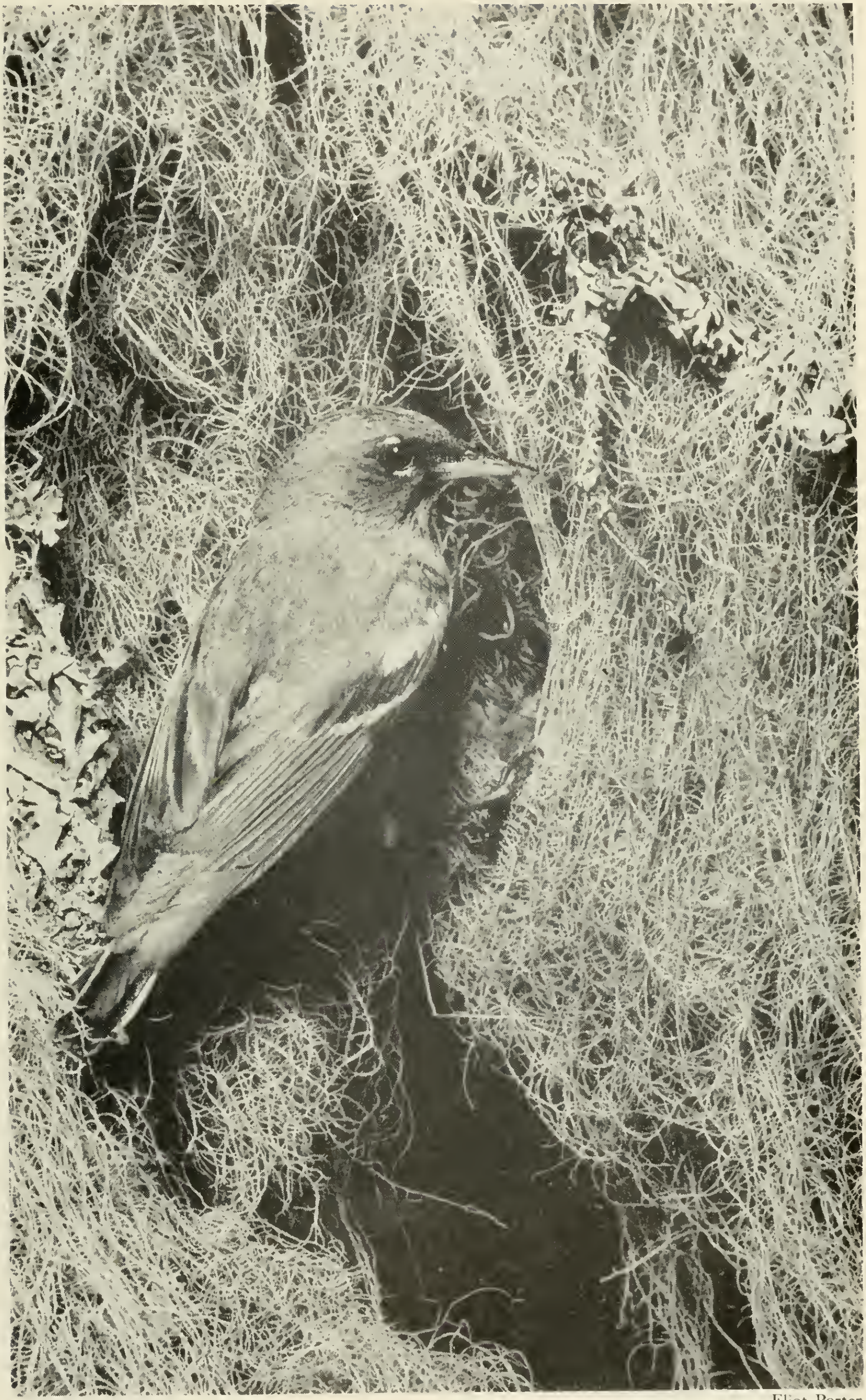
Arizona, April 29, 1941

LUCY'S WARBLER



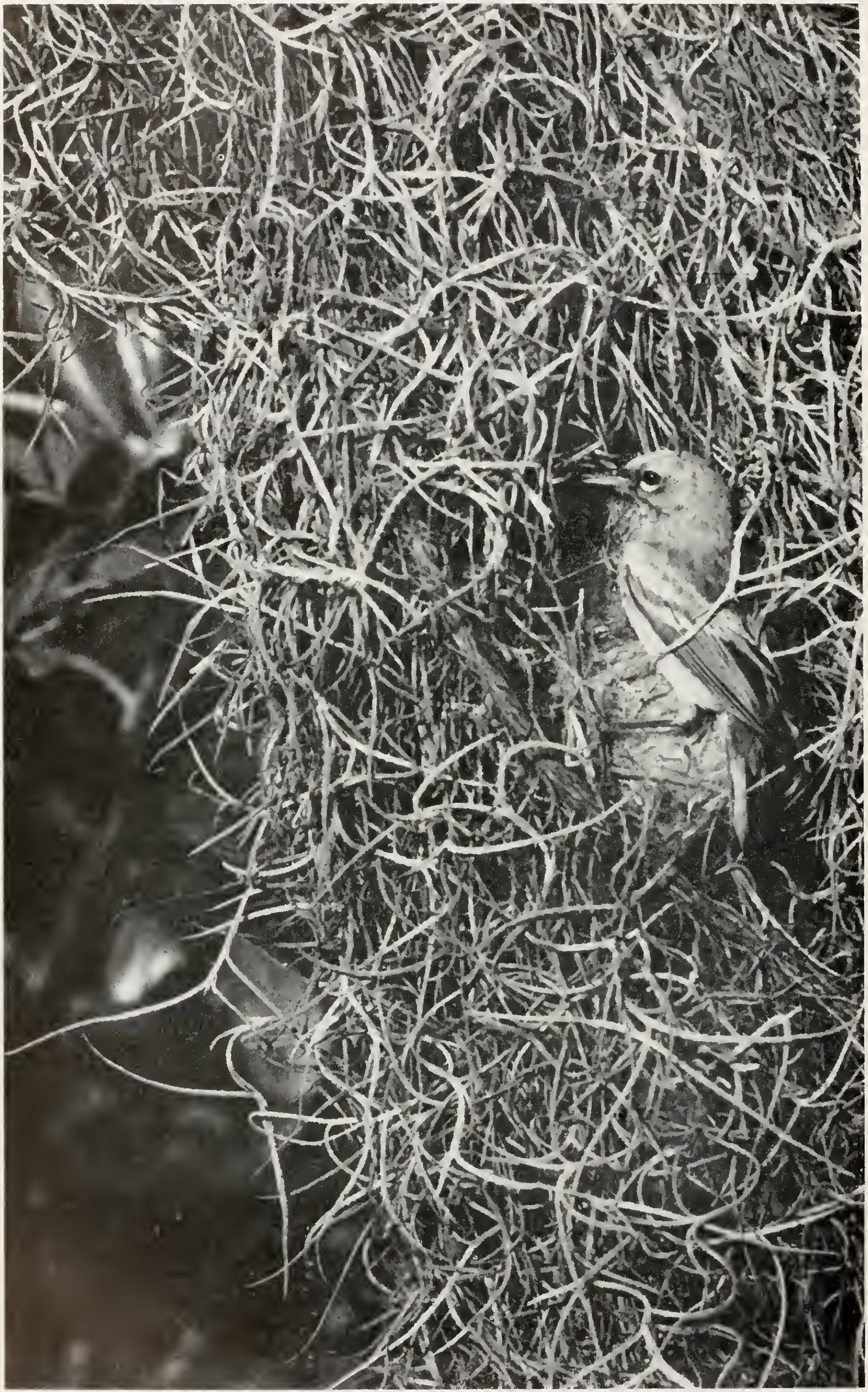
Maine C. J. Stanwood

NEST OF NORTHERN PARULA WARBLER



Maine, July 9, 1939 Eliot Porter

NORTHERN PARULA WARBLER, MALE

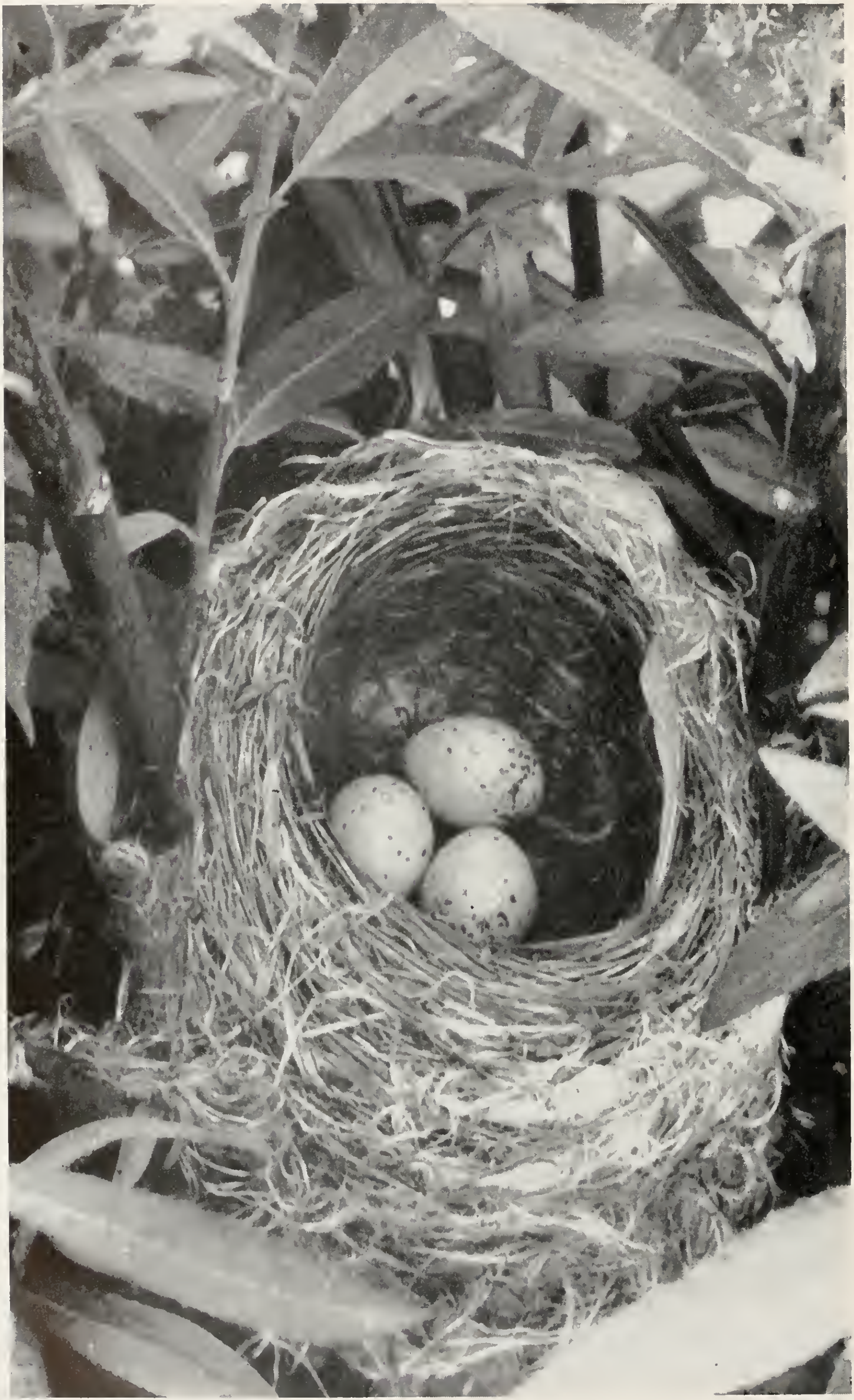


Duval County, Fla., May 4, 1936 S. A. Grimes

SOUTHERN PARULA WARBLER, MALE

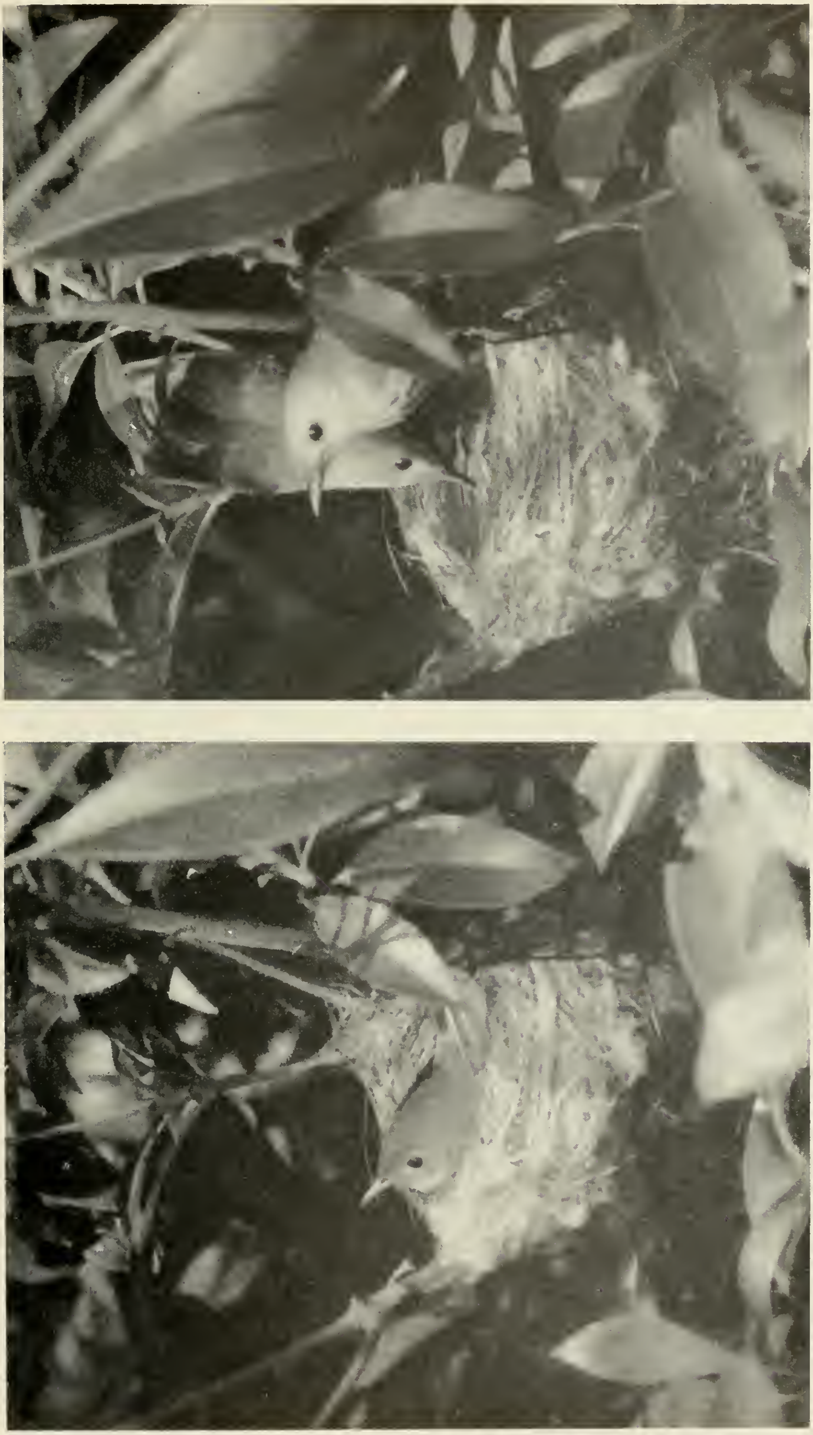
Huachuca Mountains, Ariz., May 30, 1922 A. C. Bent

NESTING SITE AND NEST OF NORTHERN OLIVE WARBLER



Erie County, N. Y., June 12, 1927 S. A. Grimes

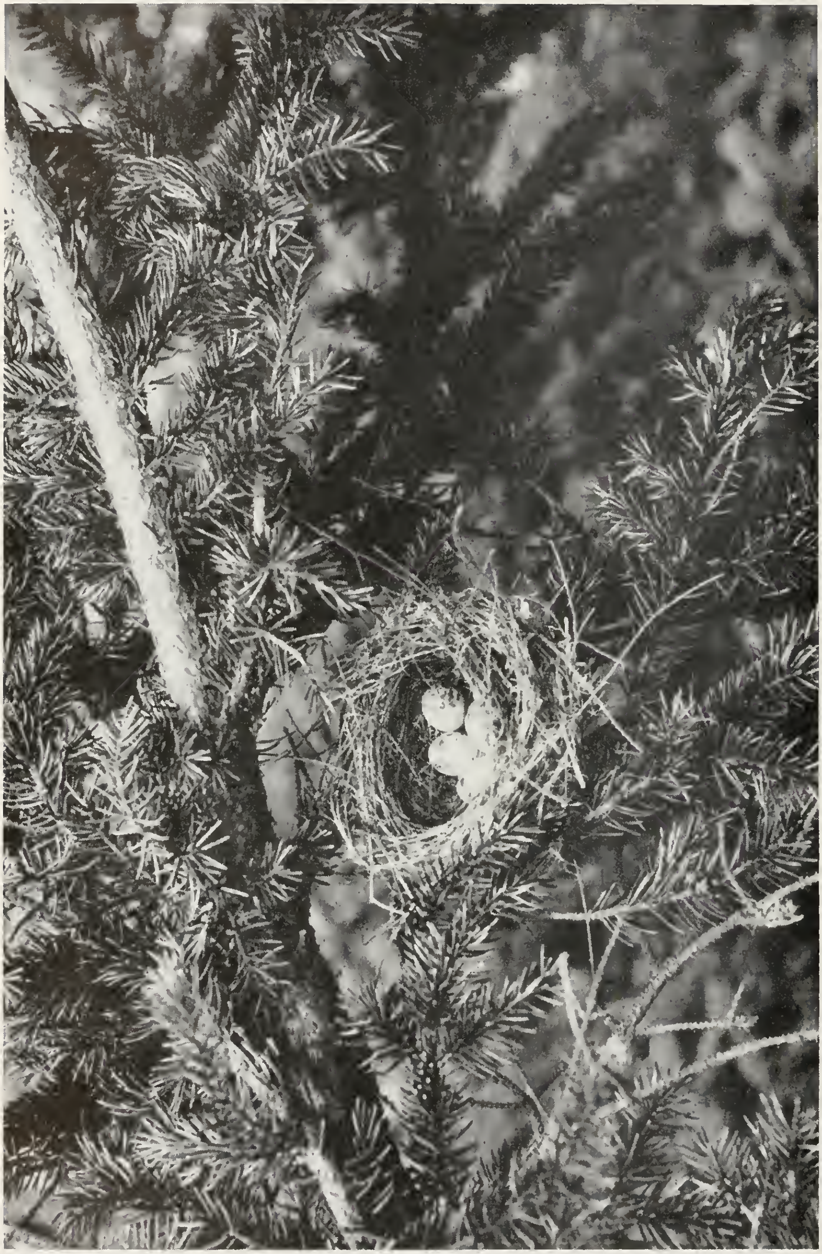
NEST OF EASTERN YELLOW WARBLER



Grice and Grice

EASTERN YELLOW WARBLERS

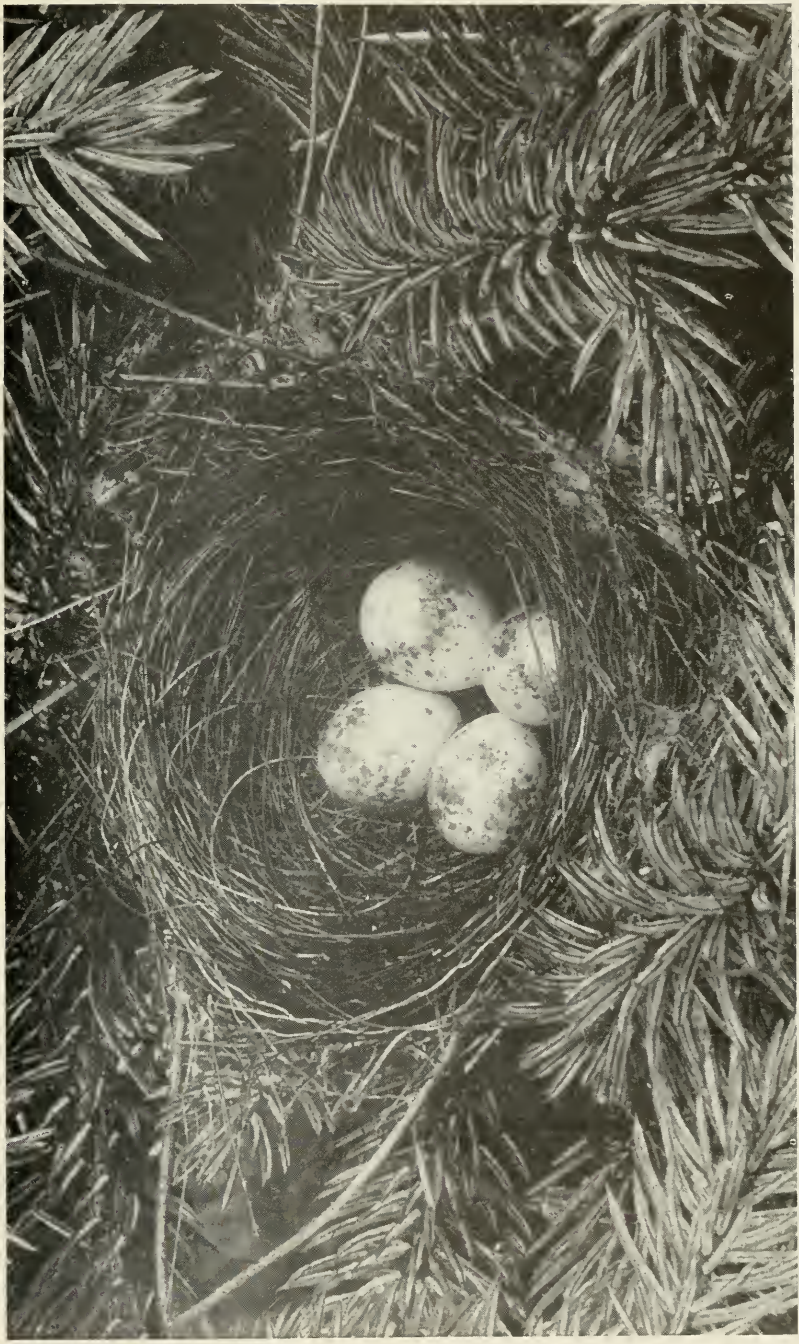
Taunton, Mass., May 31, 1941



Pocono Lake, Pa.

B. S. Bowdish

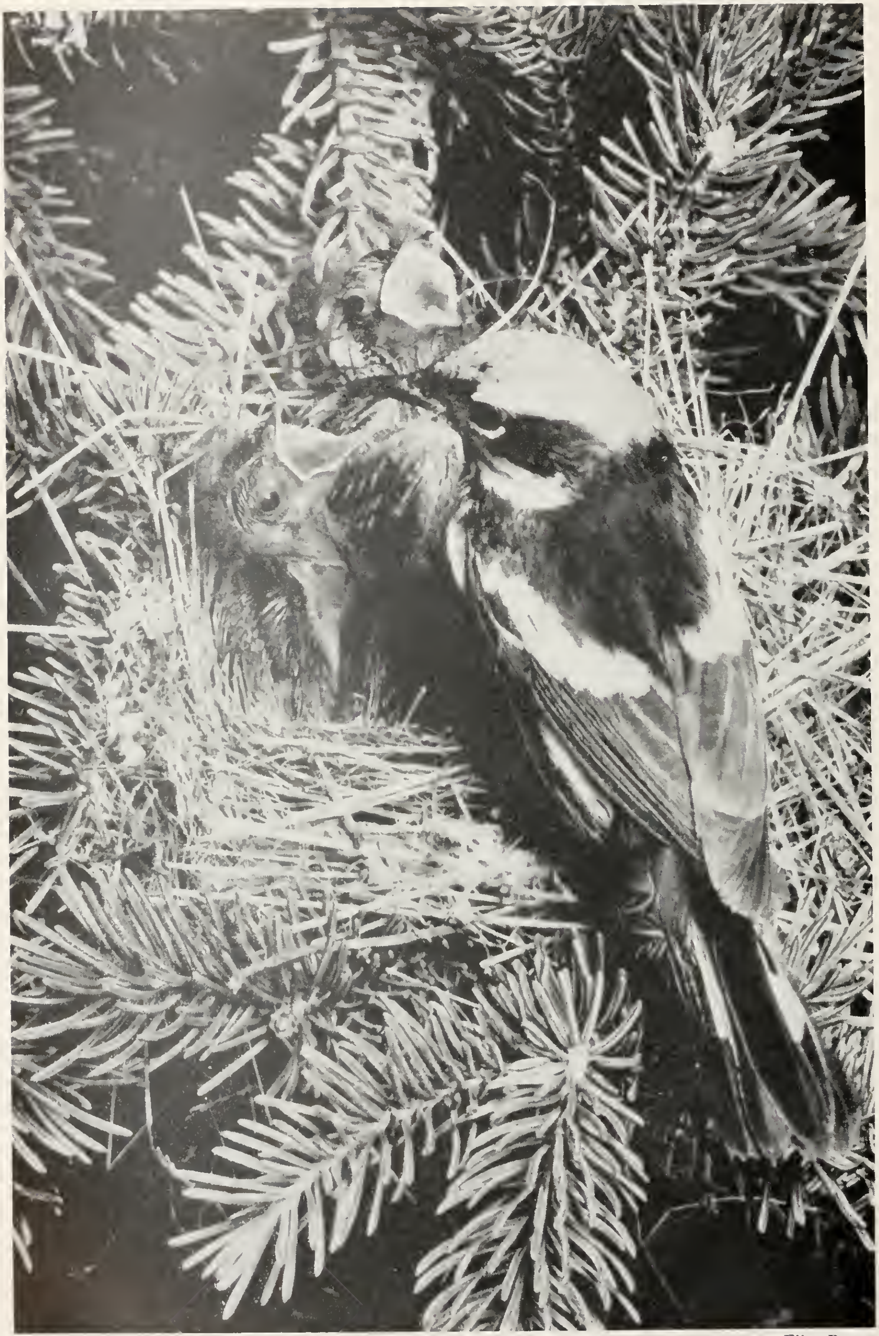
NEST OF MAGNOLIA WARBLER IN A HEMLOCK



Wyoming County, N. Y., June 5, 1928

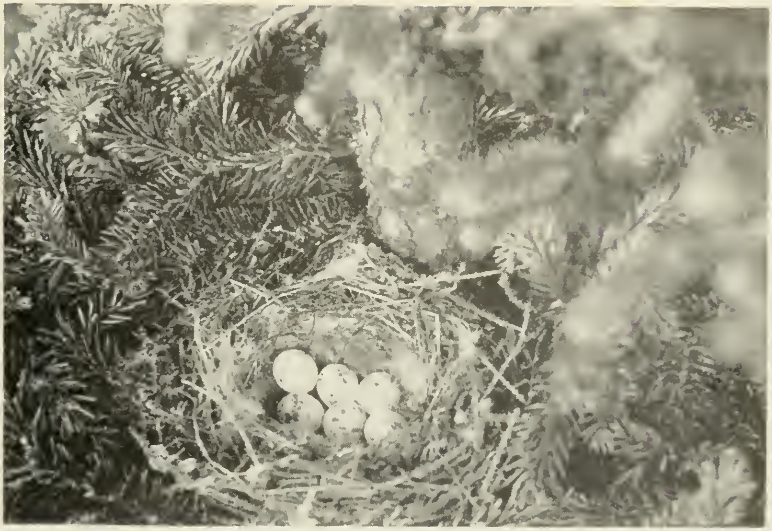
S. A. Grimes

NEST OF MAGNOLIA WARBLER

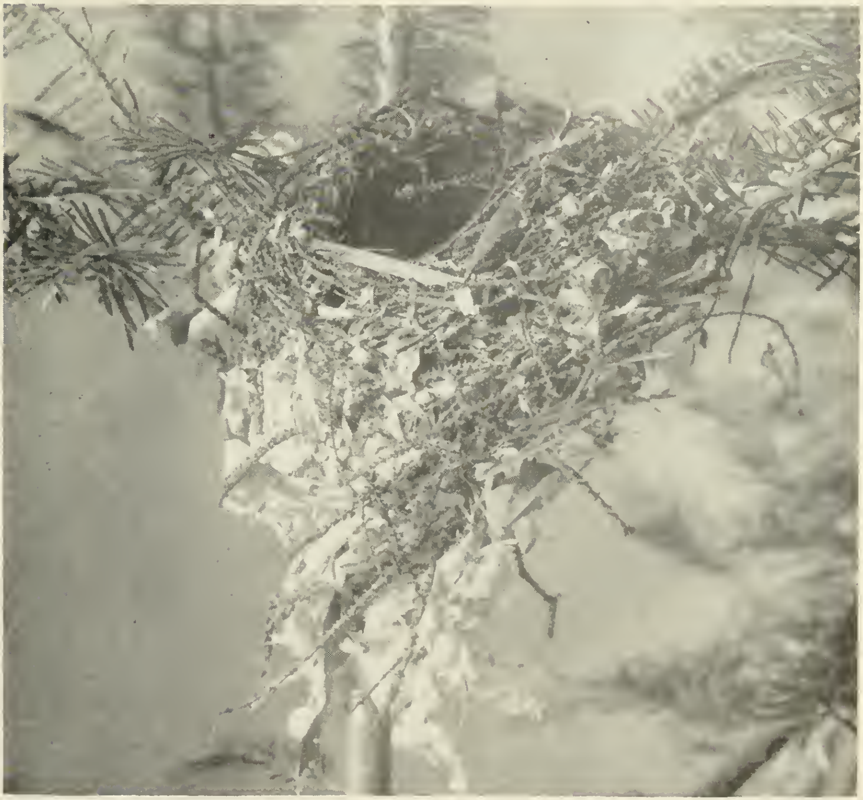


Maine, July 6, 1940 Eliot Porter

MALE MAGNOLIA WARBLER WITH YOUNG

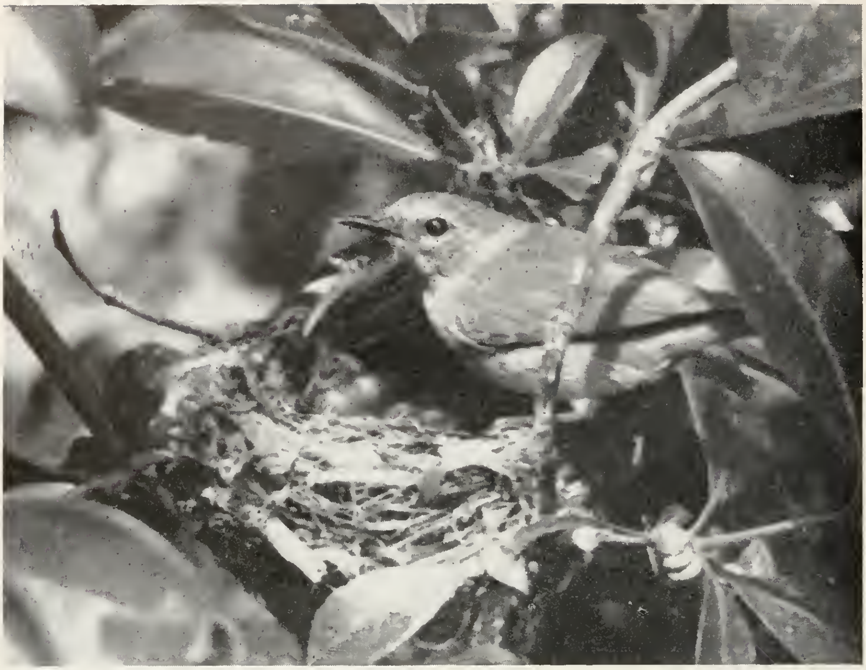


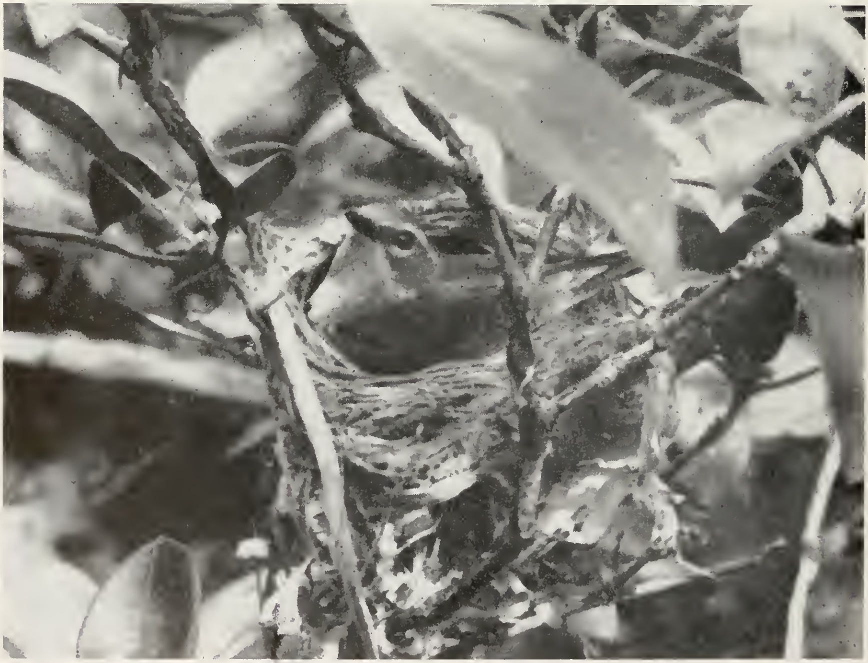
Tabusintac, New Brunswick B. S. Bowdish



Maine C. J. Stanwood

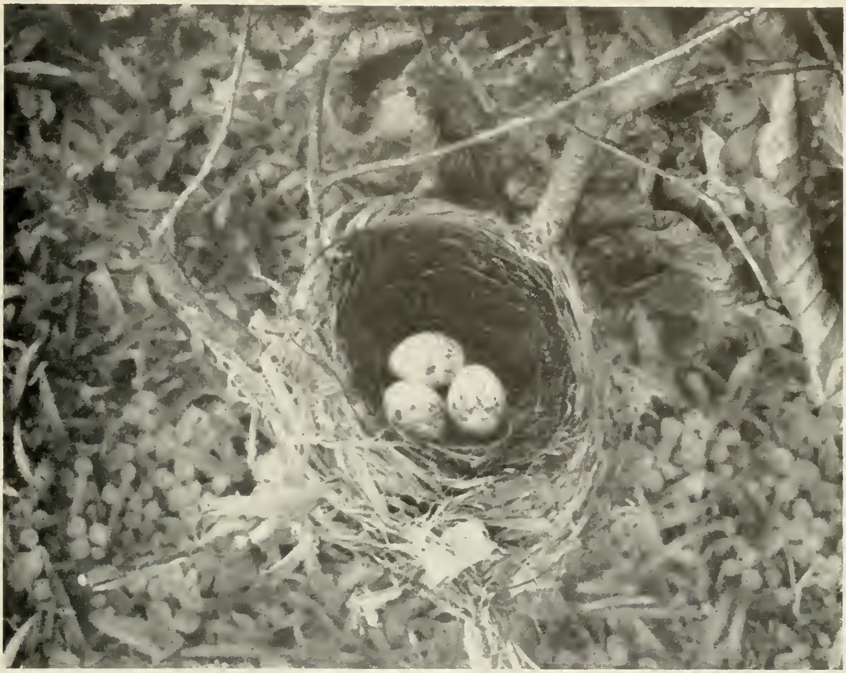
NESTS OF CAPE MAY WARBLER (UPPER) AND NORTHERN BLACK-THROATED BLUE WARBLER (LOWER)



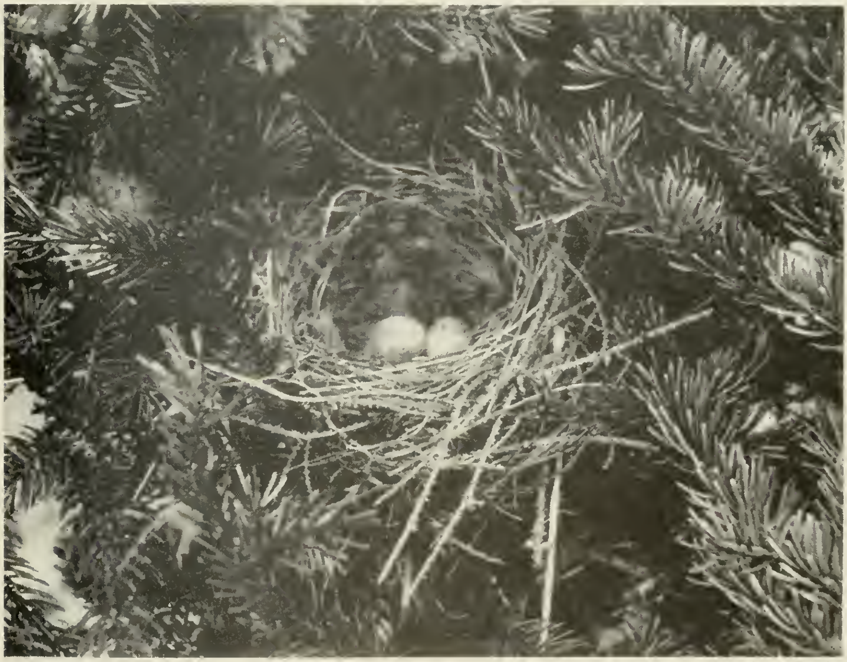


Asquam Lake, N. H., June 25, 1927 A. C. Bent

NORTHERN BLACK-THROATED BLUE WARBLER, FEMALES

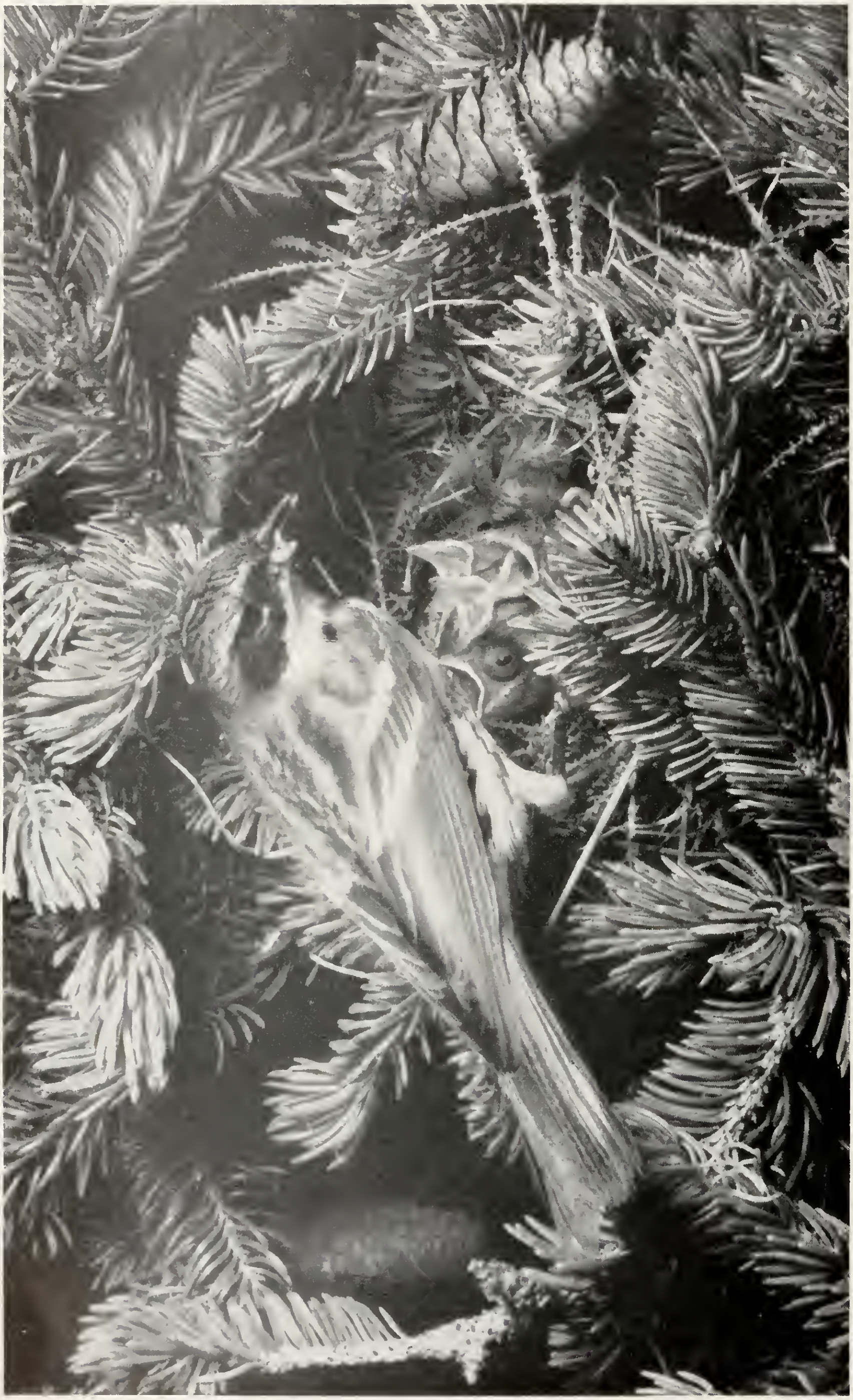


Beech Mountain, N. C., June 4, 1942 B. P. Tyler



East Wallingford, Vt., June 2, 1907 Owen Durfee

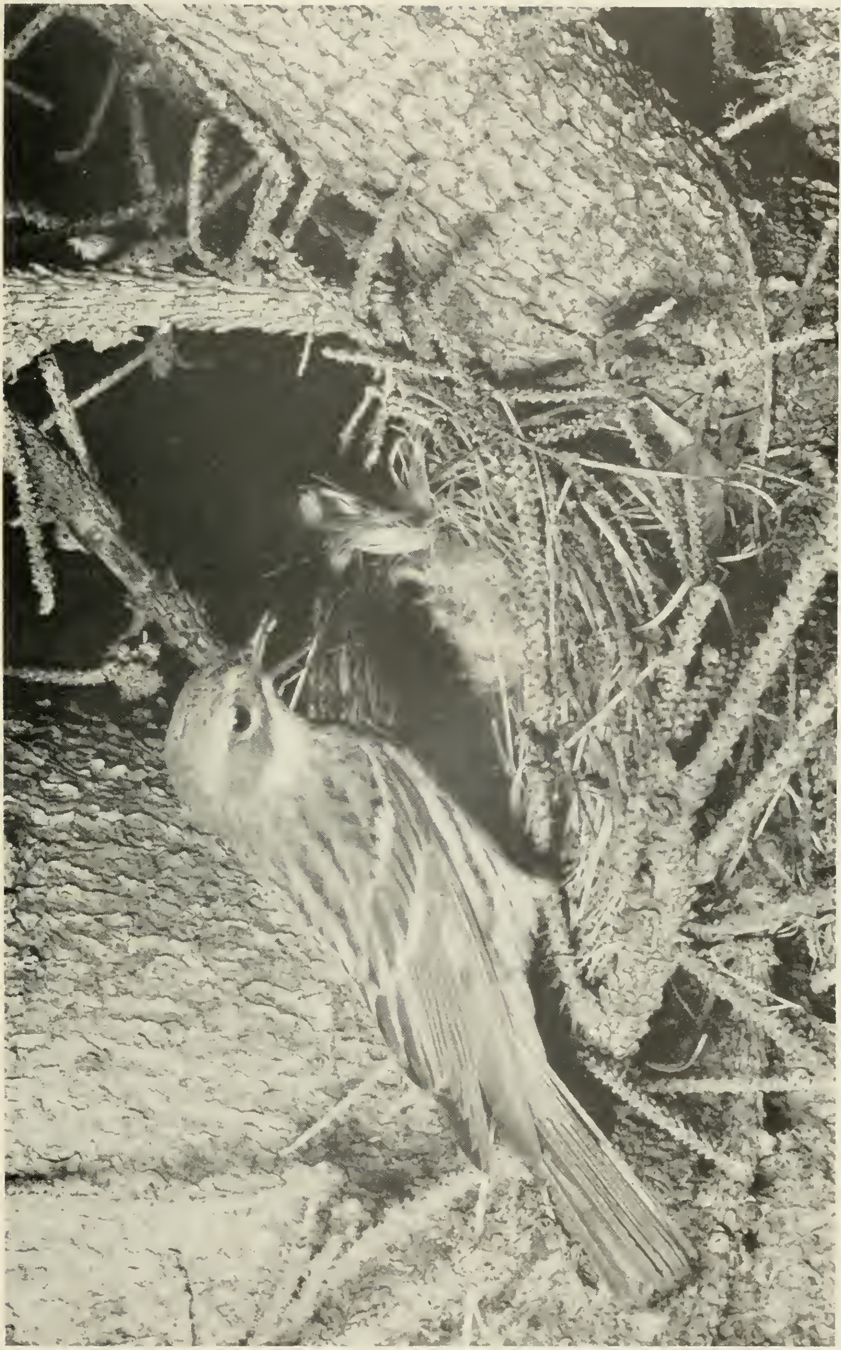
NESTS OF CAIRNS' WARBLER (UPPER) AND EASTERN MYRTLE WARBLE (LOWER)



Eliot Porter

Eastern Myrtle Warbler

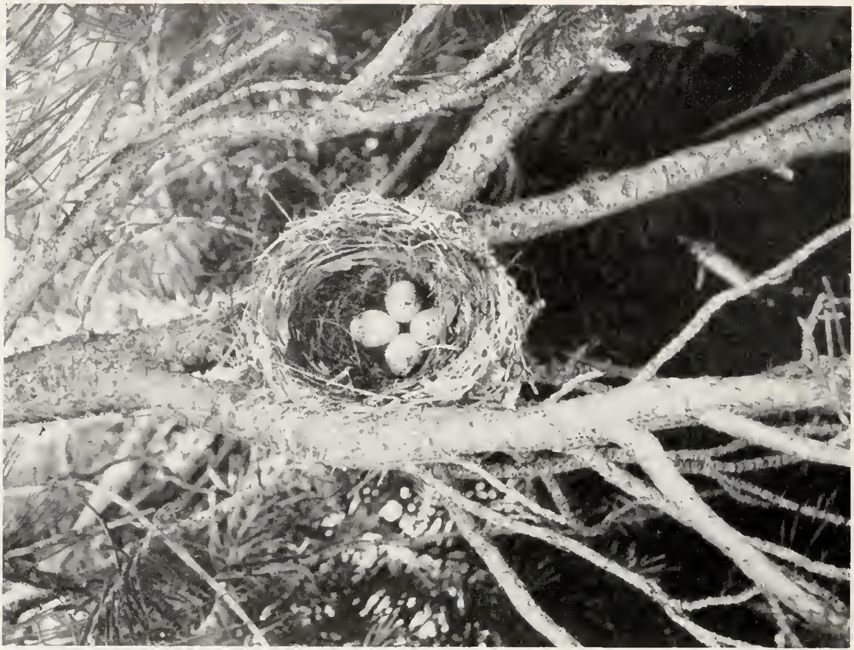
Maine, 1945



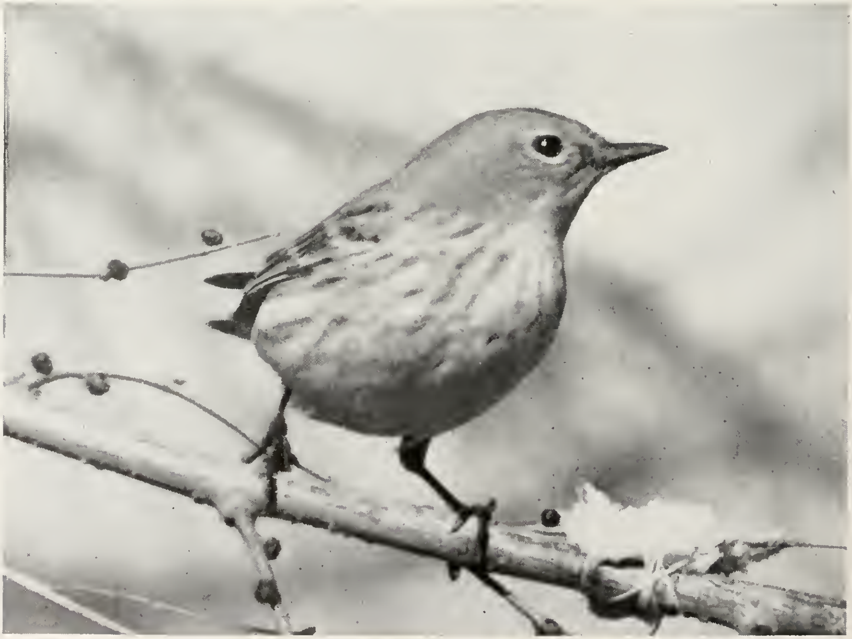
Maine, June 18, 1940

Eliot Porter

Eastern Myrtle Warbler, Female

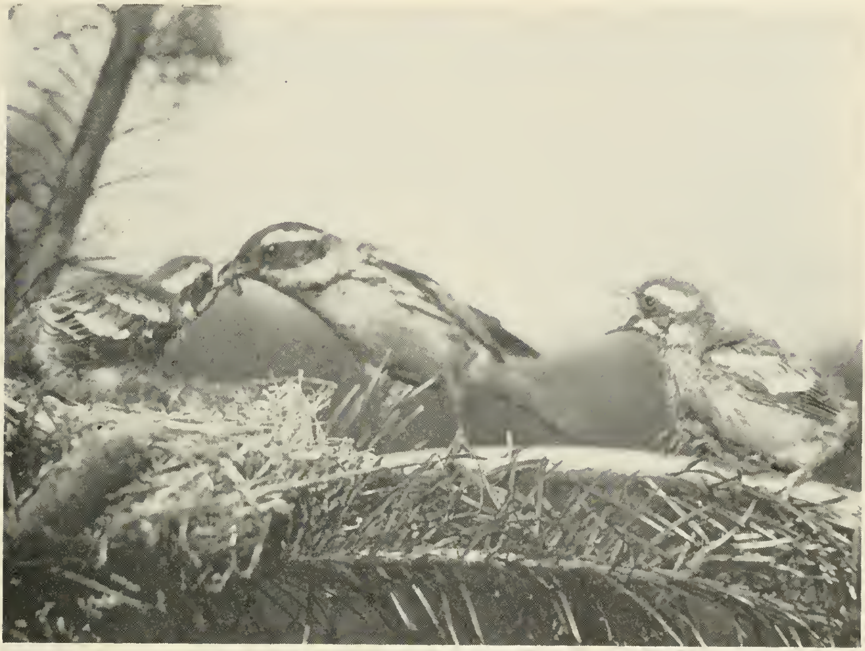


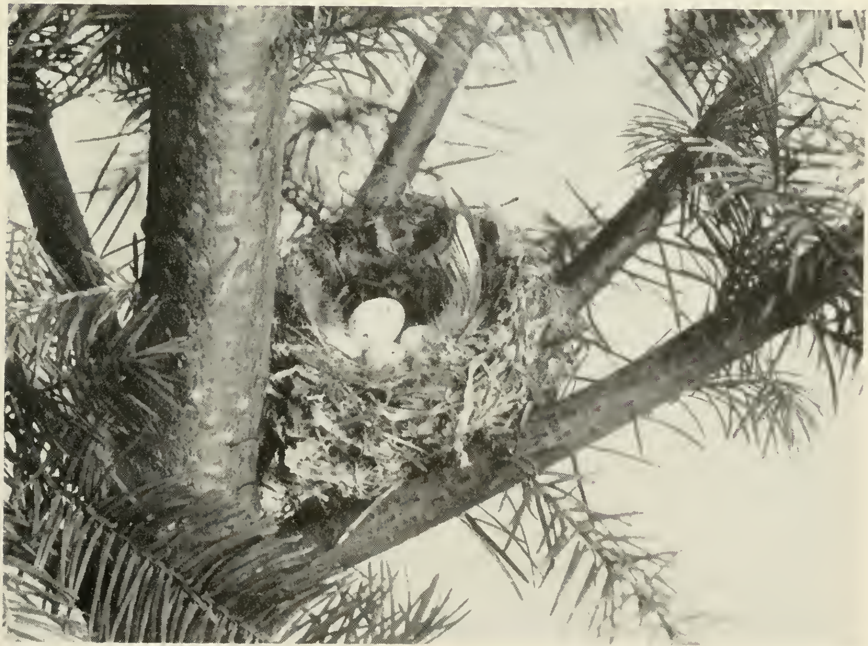
San Bernardino County, Calif., May 19, 1940 J. S. Rowley



Phoenix, Ariz., Jan. 3, 1942 H. L. and Ruth Crockett

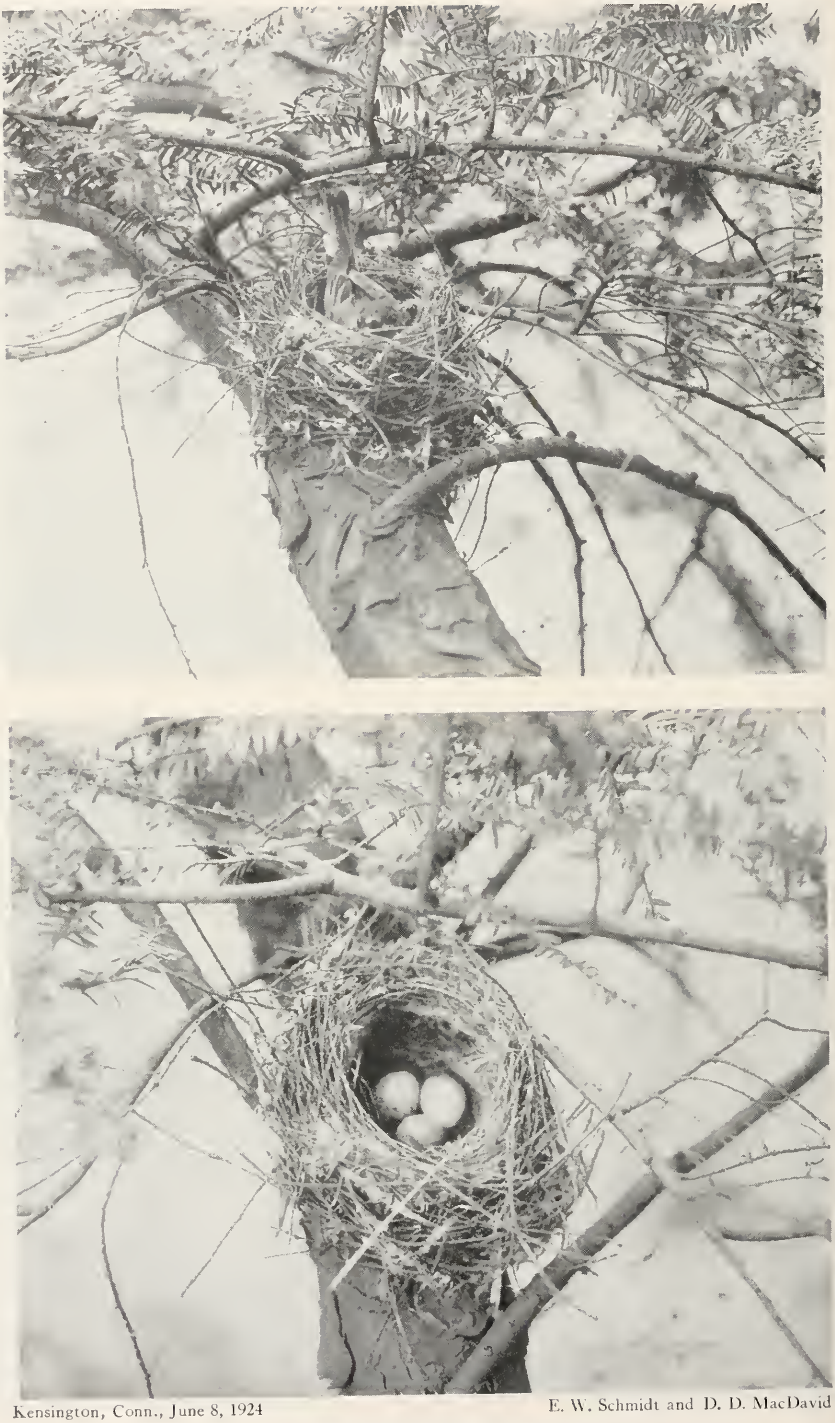
NEST OF PACIFIC AUDUBON'S WARBLER AND BIRD IN WINTER PLUMAGE





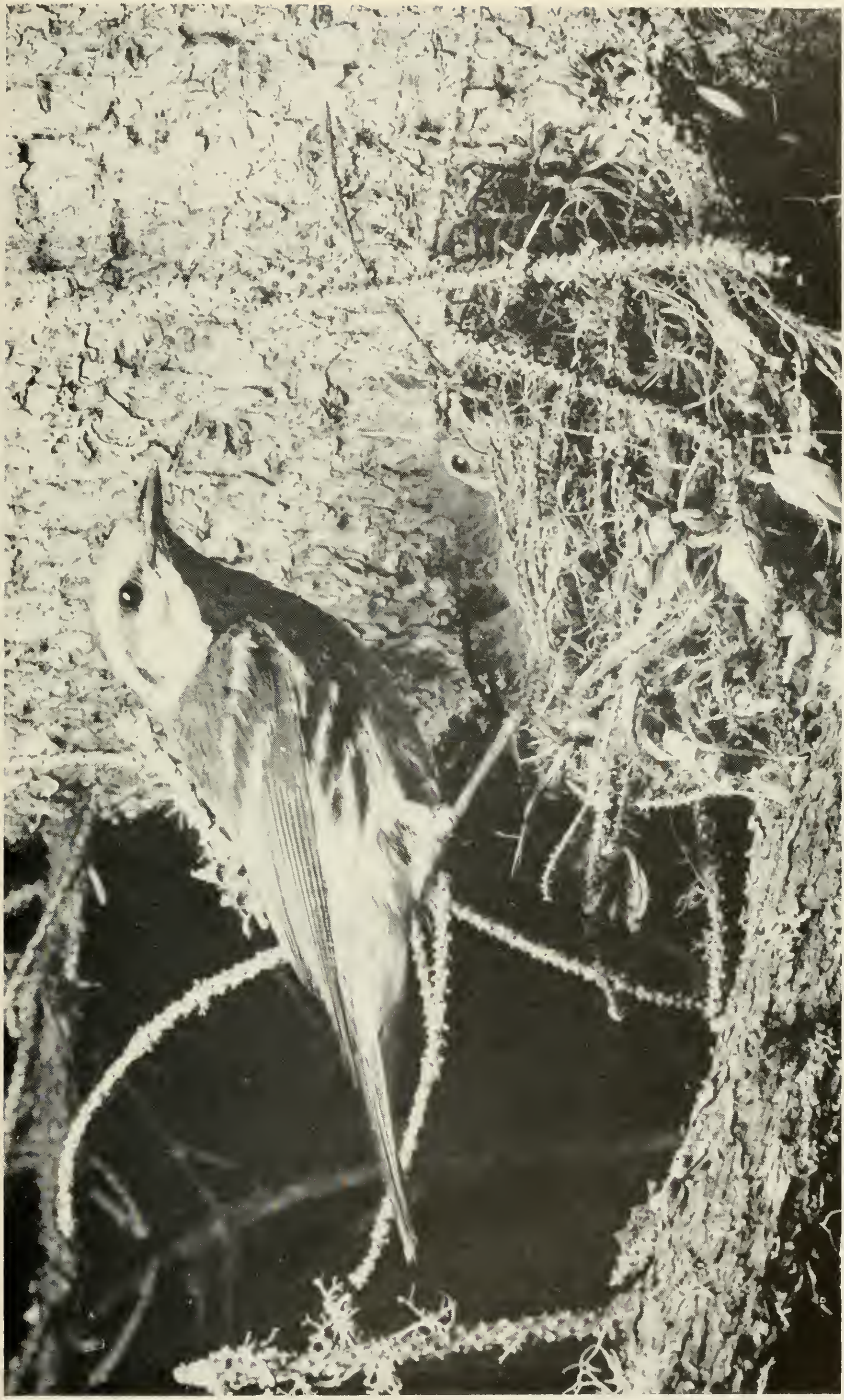
Oregon W. L. Finley

BLACK-THROATED GRAY WARBLERS AND NEST



Kensington, Conn., June 8, 1924 E. W. Schmidt and D. D. MacDavid

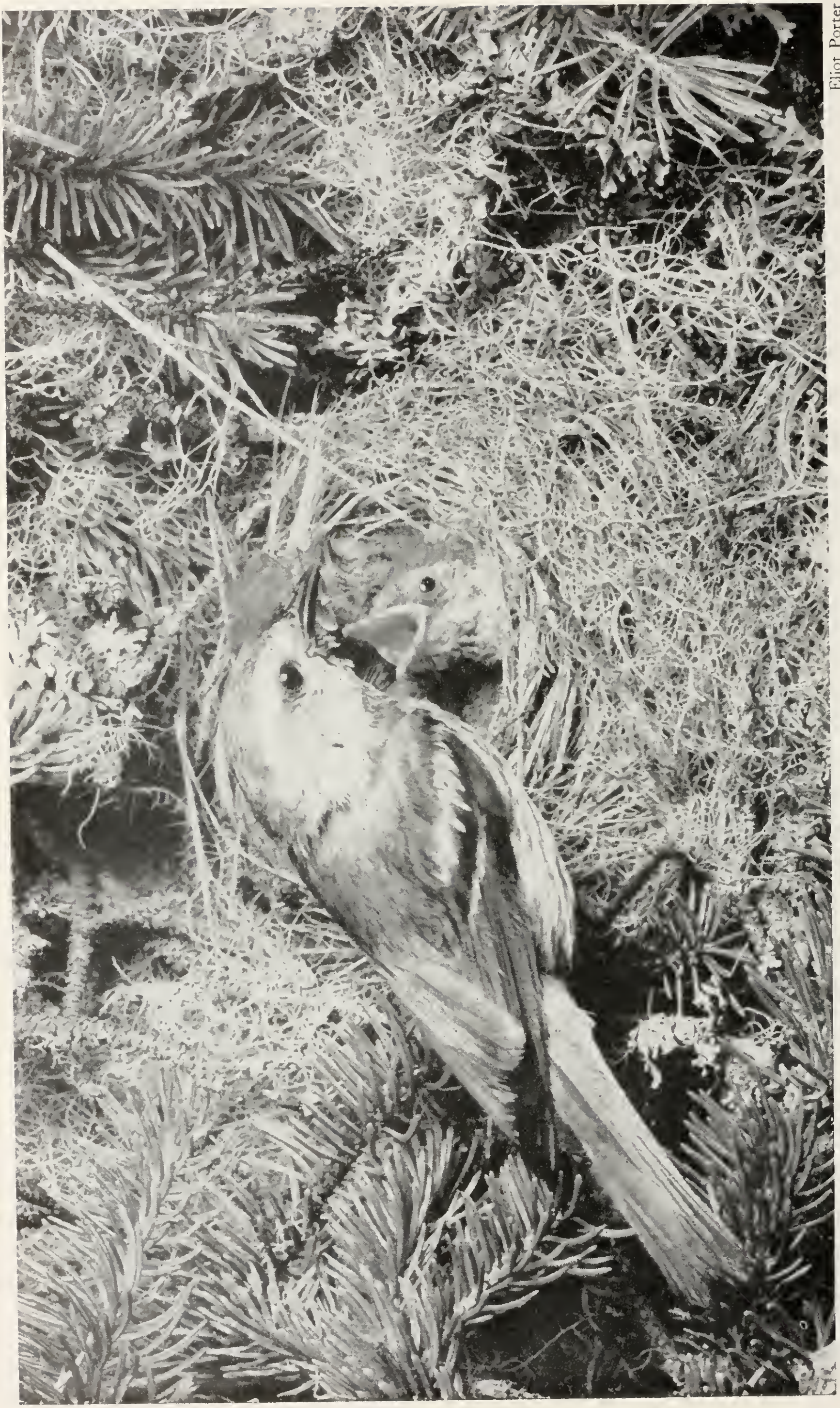
NORTHERN BLACK-THROATED GREEN WARBLER AND NEST



Eliot Porter

Maine, June 29, 1939

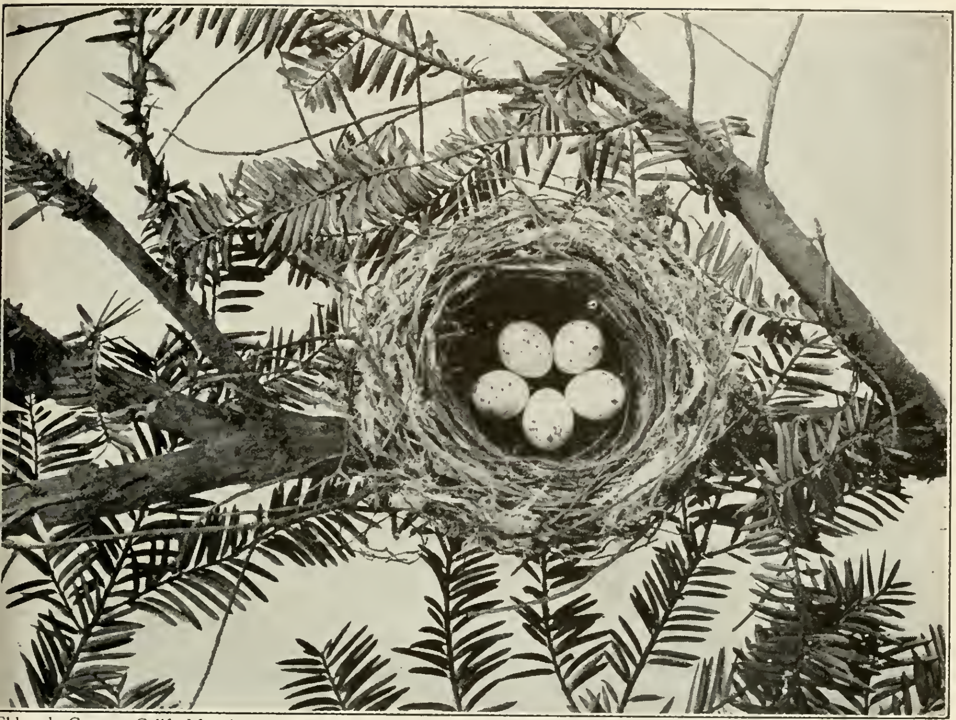
NORTHERN BLACK-THROATED GREEN WARBLER, MALE



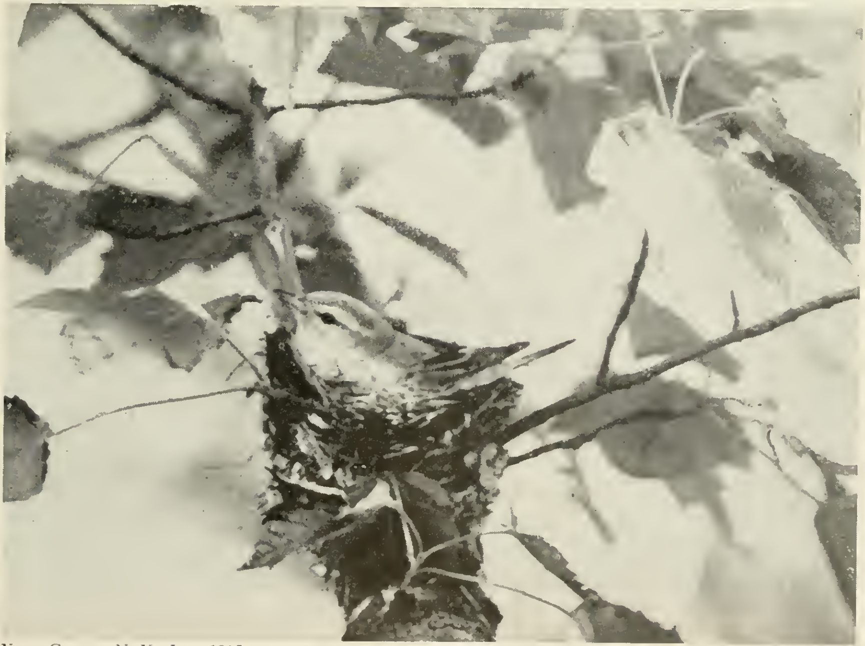
Eliot Porter

NORTHERN BLACK-THROATED GREEN WARBLER. FEMALE

Maine, July 24, 1940

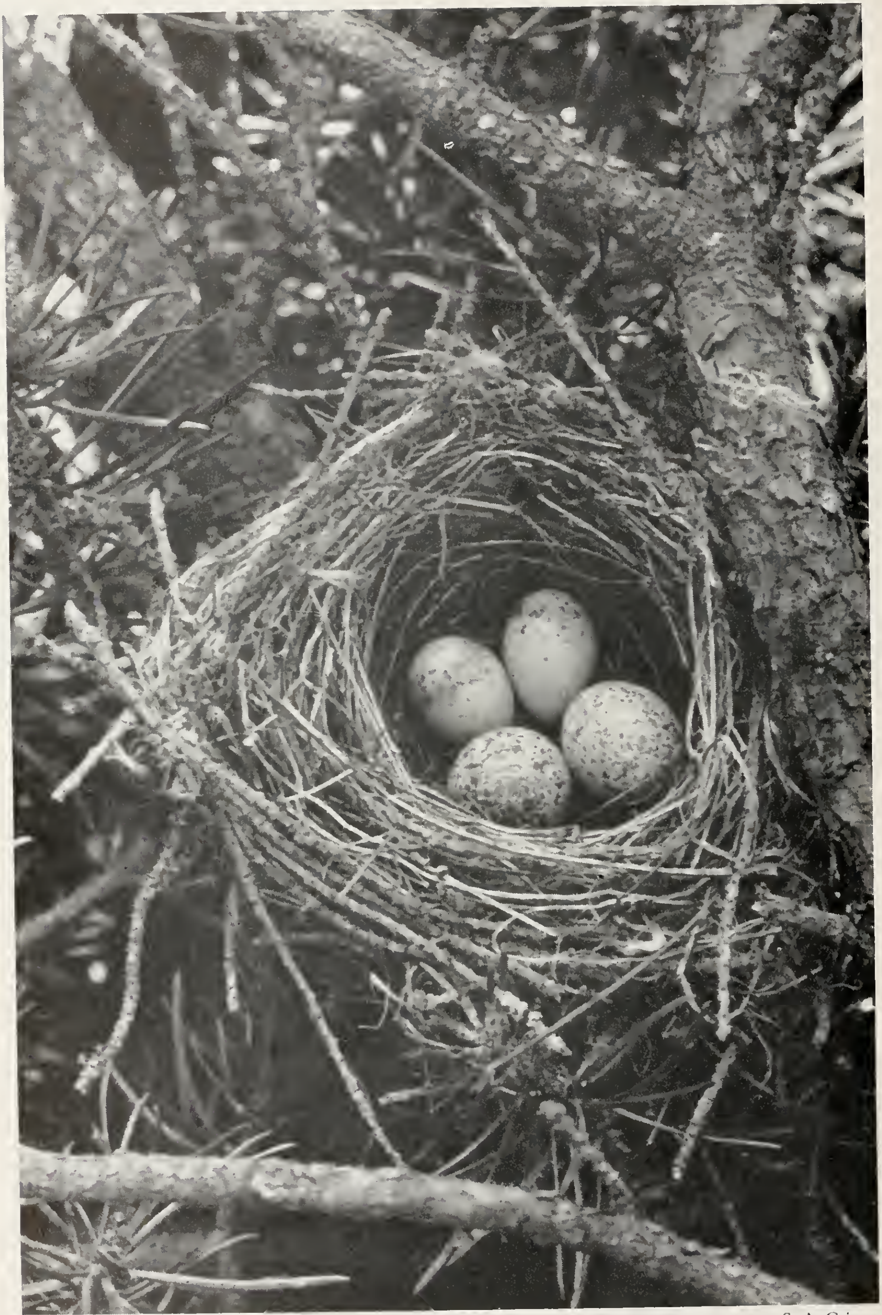


ldorado County, Calif., May 14, 1913 O. F. Heinman (Courtesy *The Condor* and M. S. Ray)



Yates County, N. Y., June 1915 C. F. Stone

HERMIT WARBLER'S NEST (UPPER) AND CERULEAN WARBLER (LOWER)

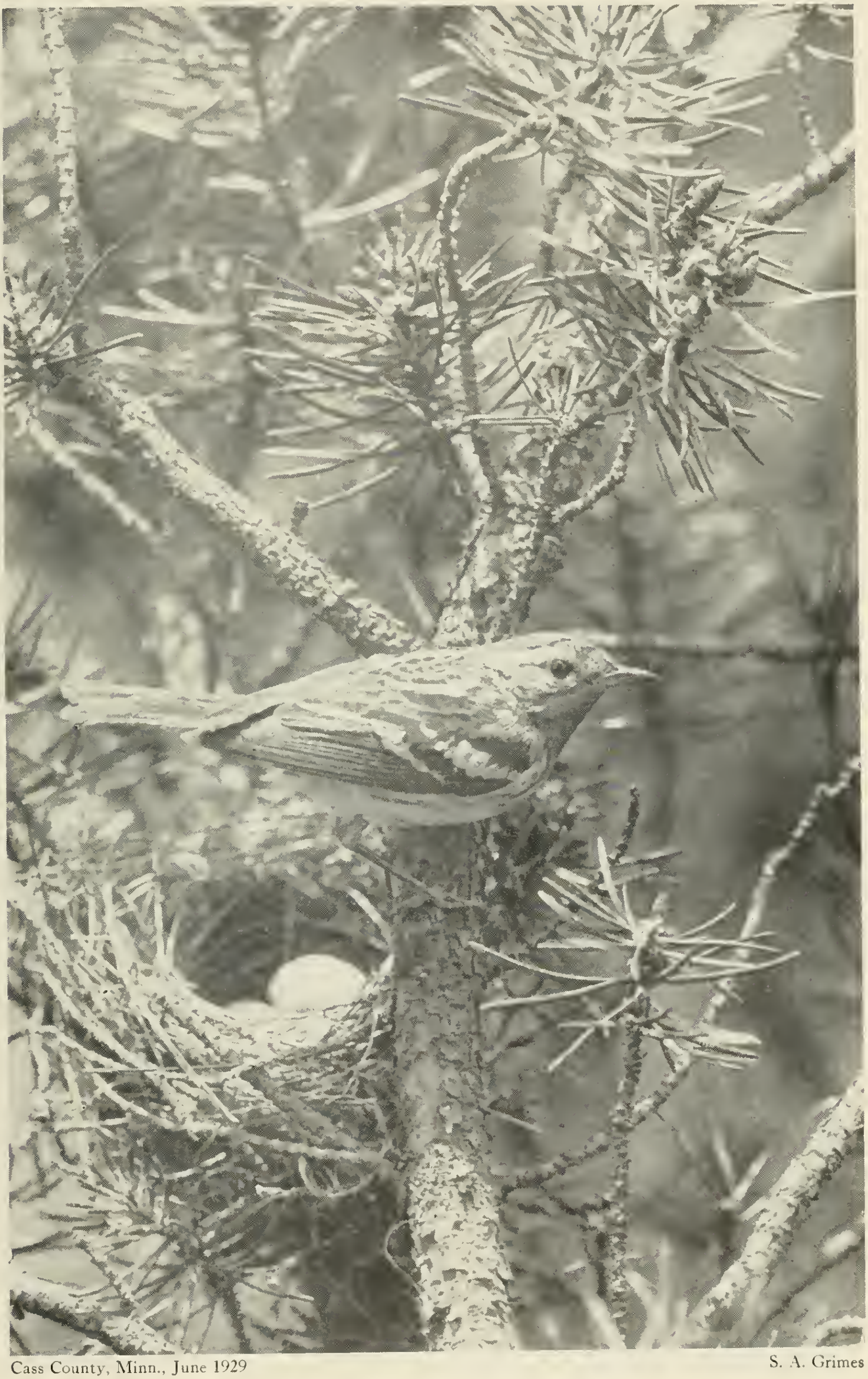


Cass County, Minn., June 22, 1929

S. A. Grimes

BLACKBURNIAN WARBLER'S NEST

(Note two cowbird eggs in nest)

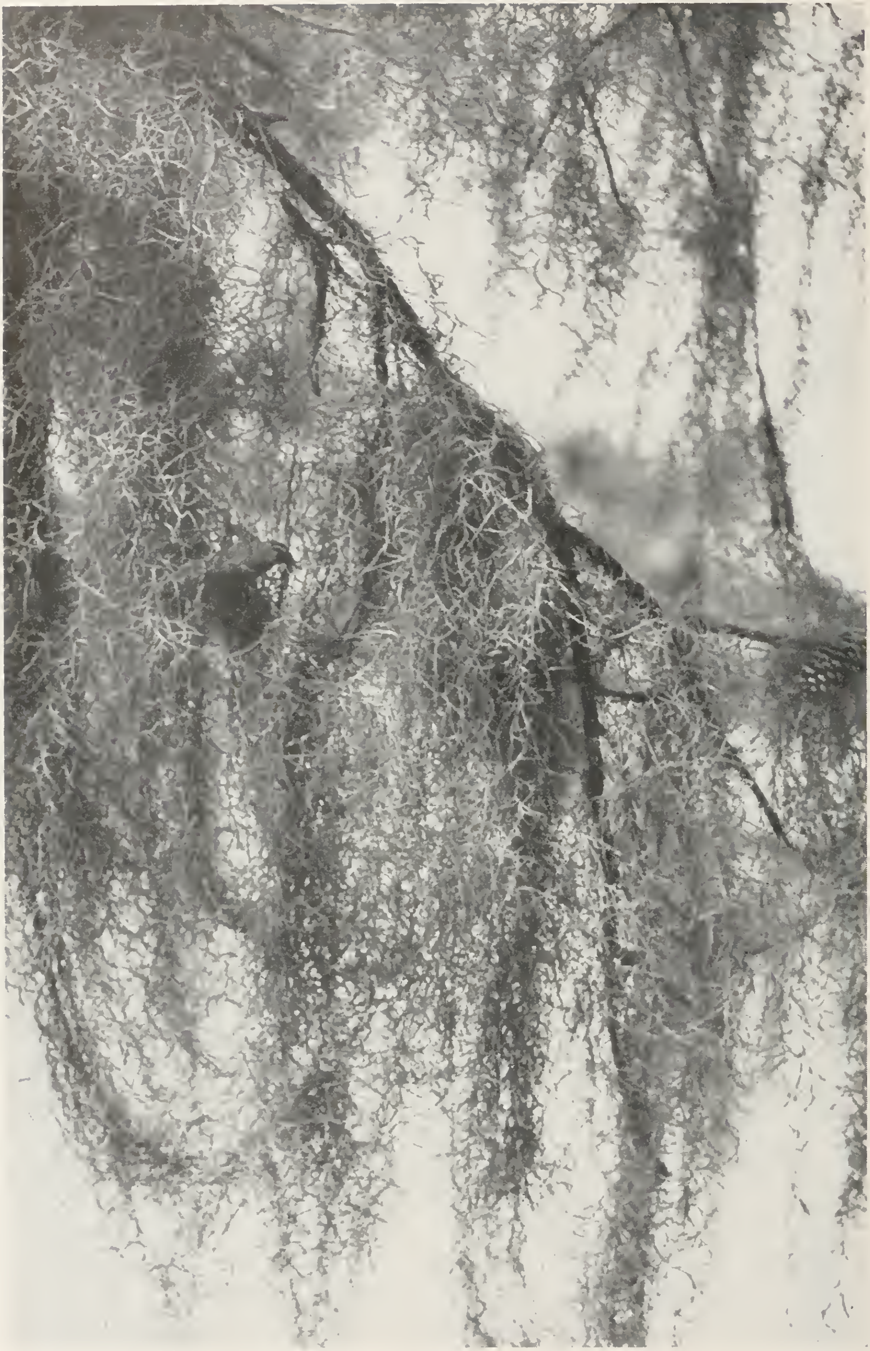


Cass County, Minn., June 1929

S. A. Grimes

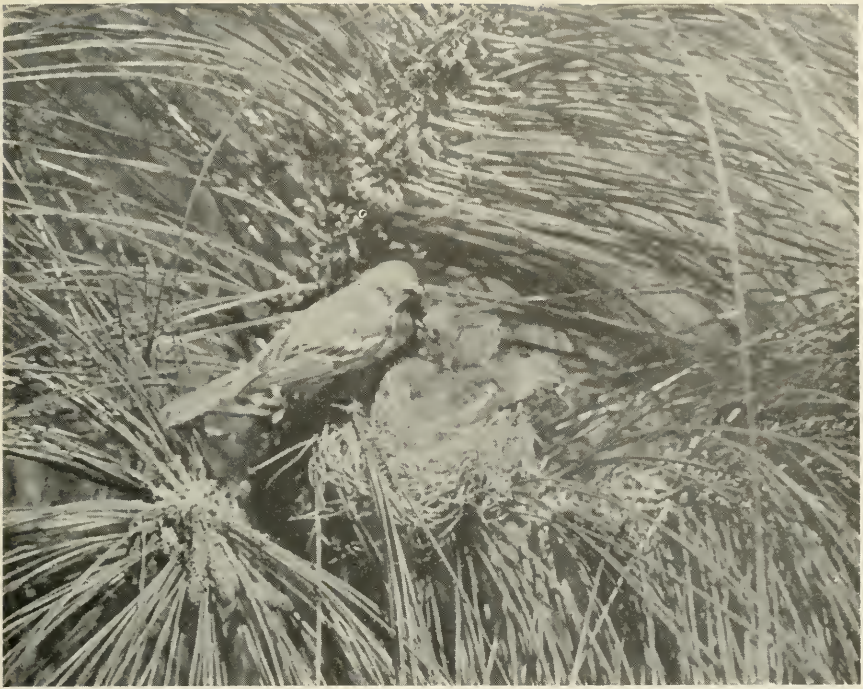
BLACKBURNIAN WARBLER, MALE

(One cowbird egg in nest)

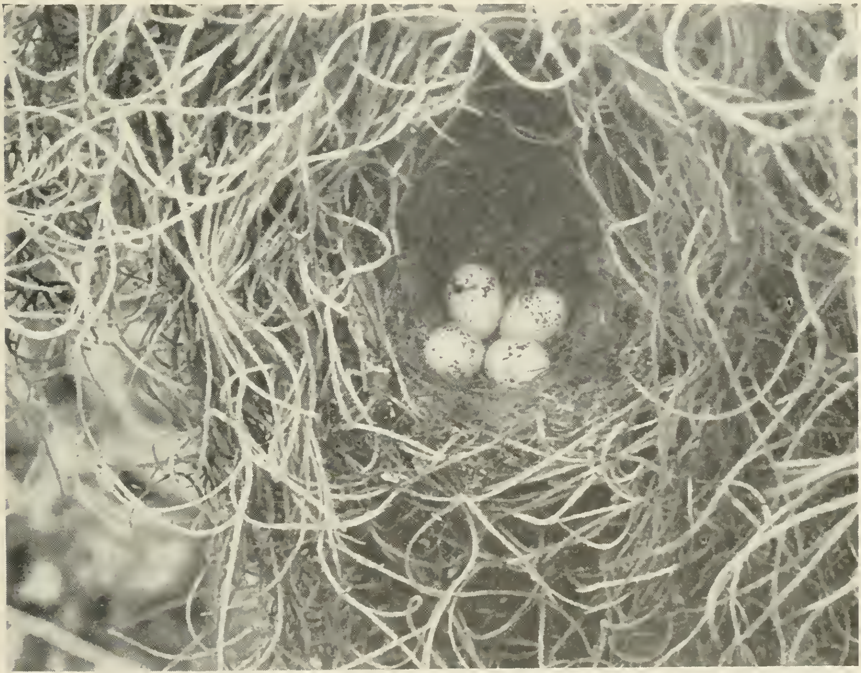


Duval County, Fla., April 27, 1936 S. A. Grimes

EASTERN YELLOW-THROATED WARBLER

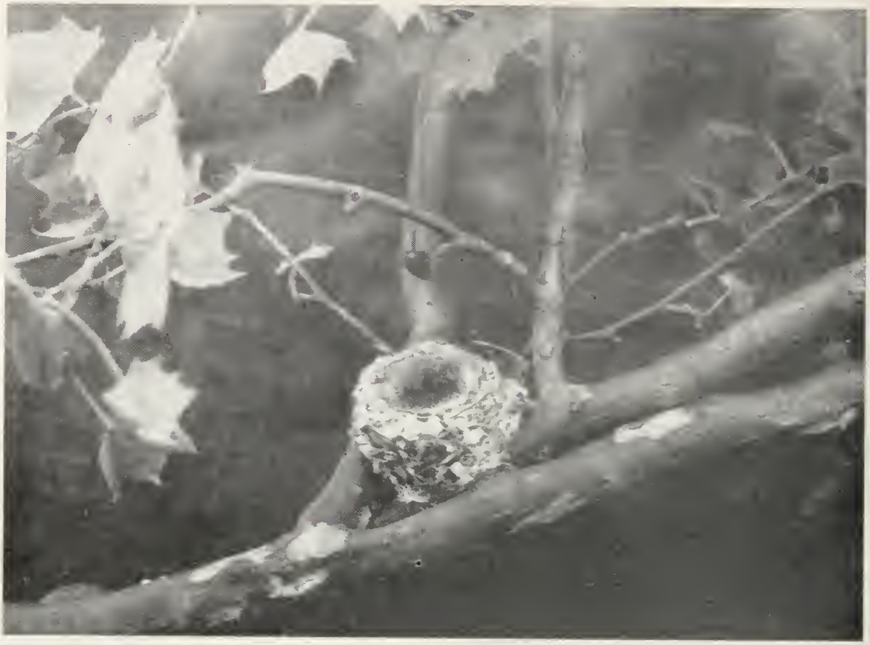


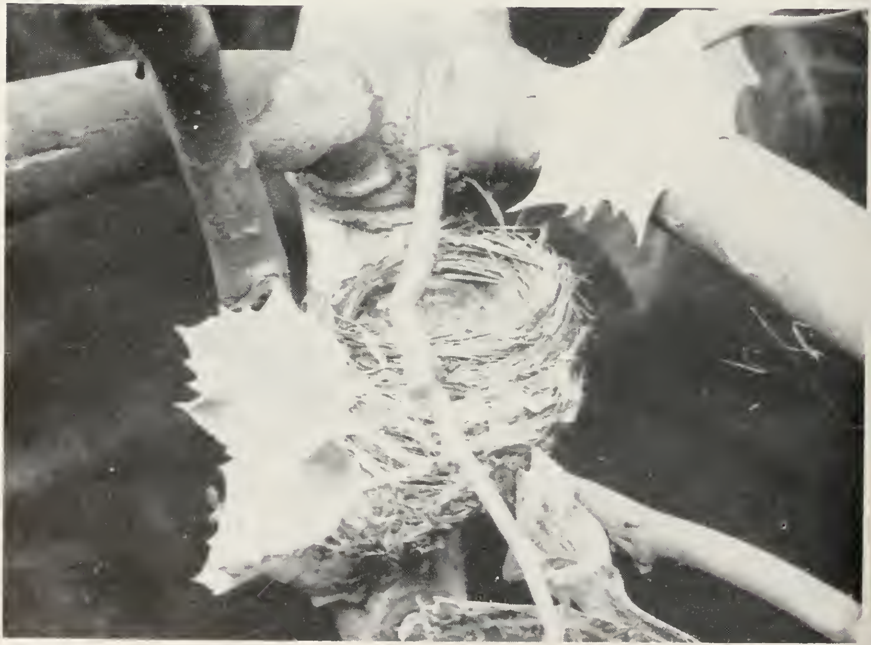
Duval County, Fla., May 1934 S. A. Grimes



Duval County, Fla., May 2, 1931 S. A. Grimes

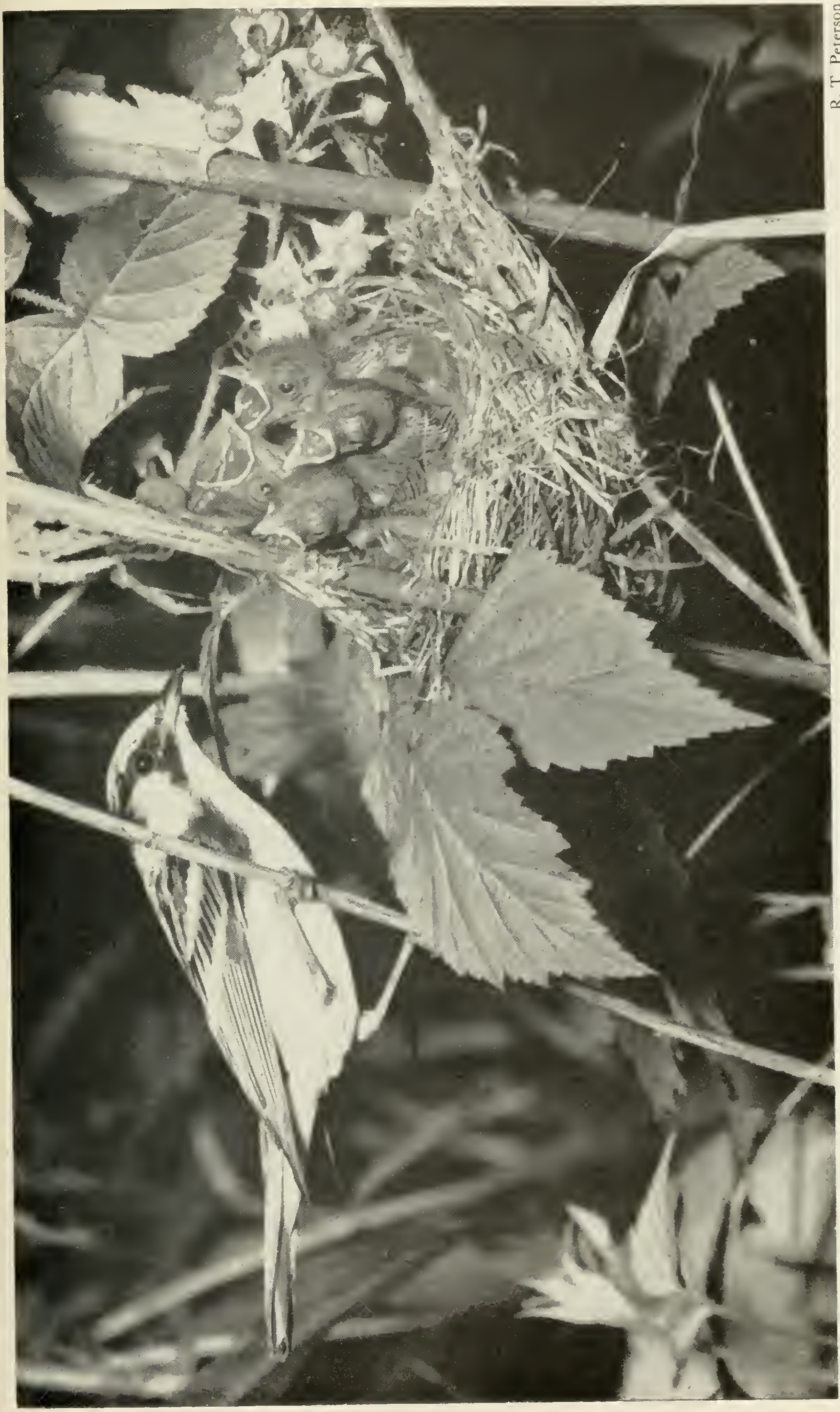
EASTERN YELLOW-THROATED WARBLER AND NEST





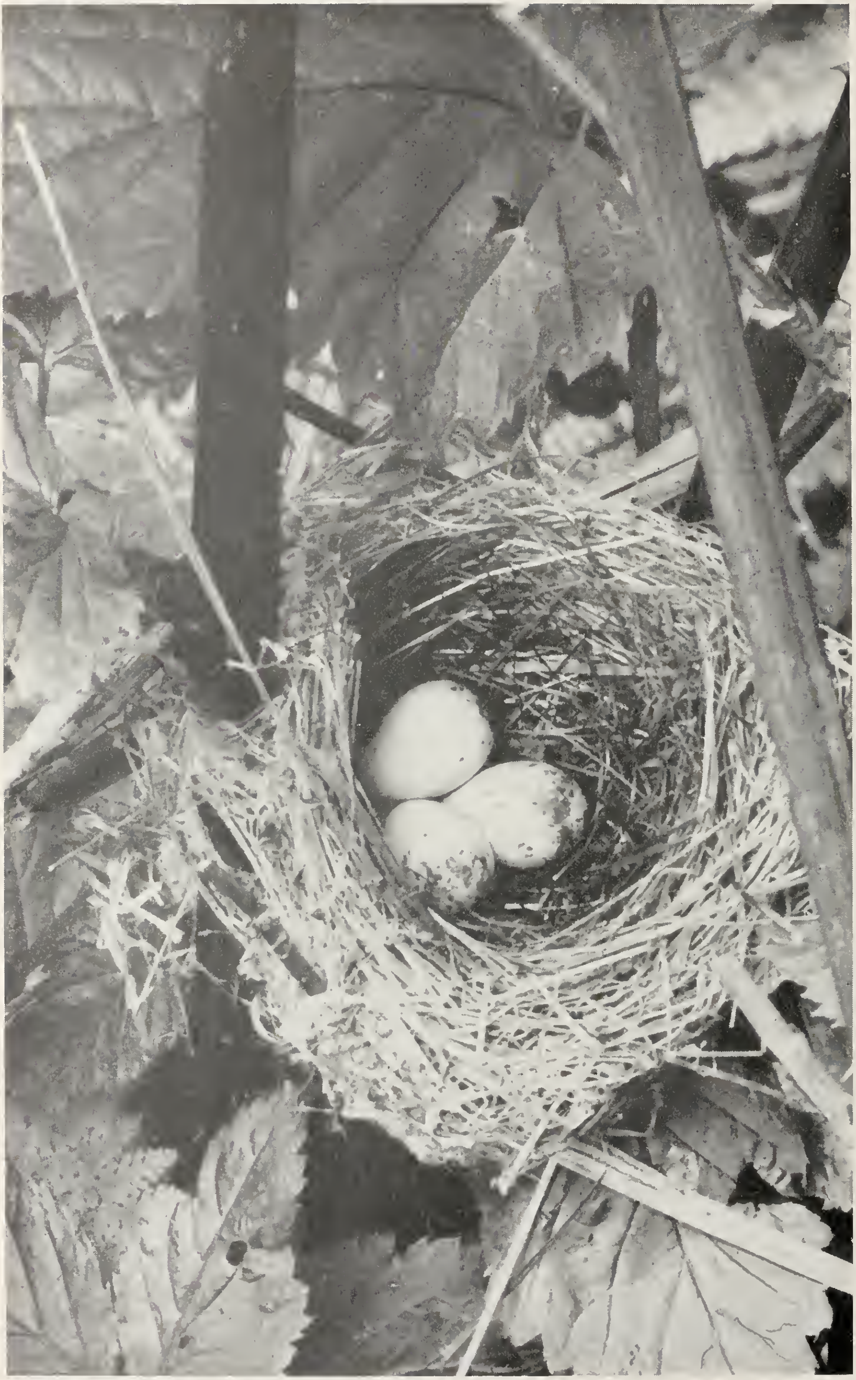
Tennessee H. S. Vaughn

NESTS OF SYCAMORE YELLOW-THROATED WARBLER



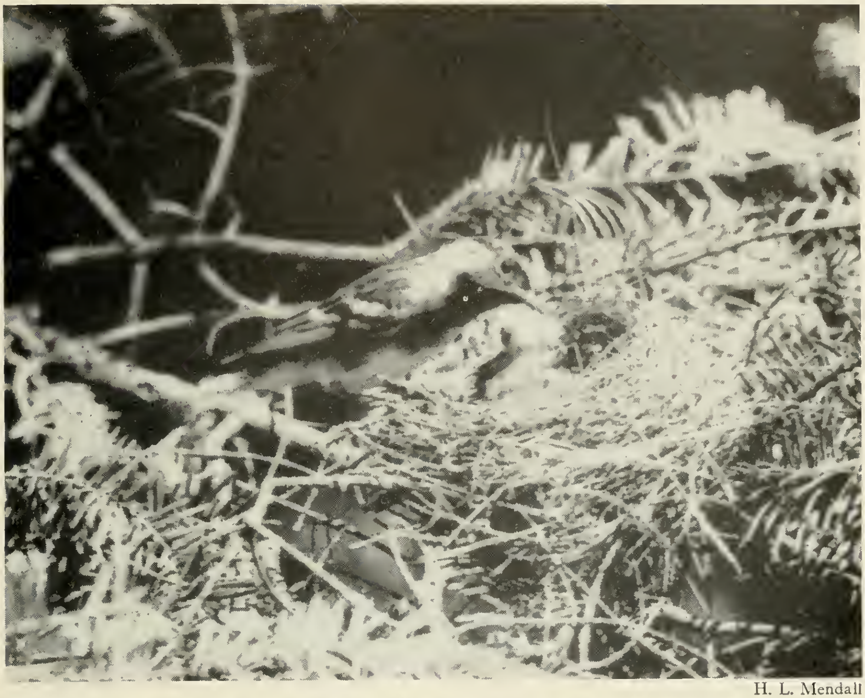
Dutchess County, N. Y. R. T. Peterson

CHESTNUT-SIDED WARBLER

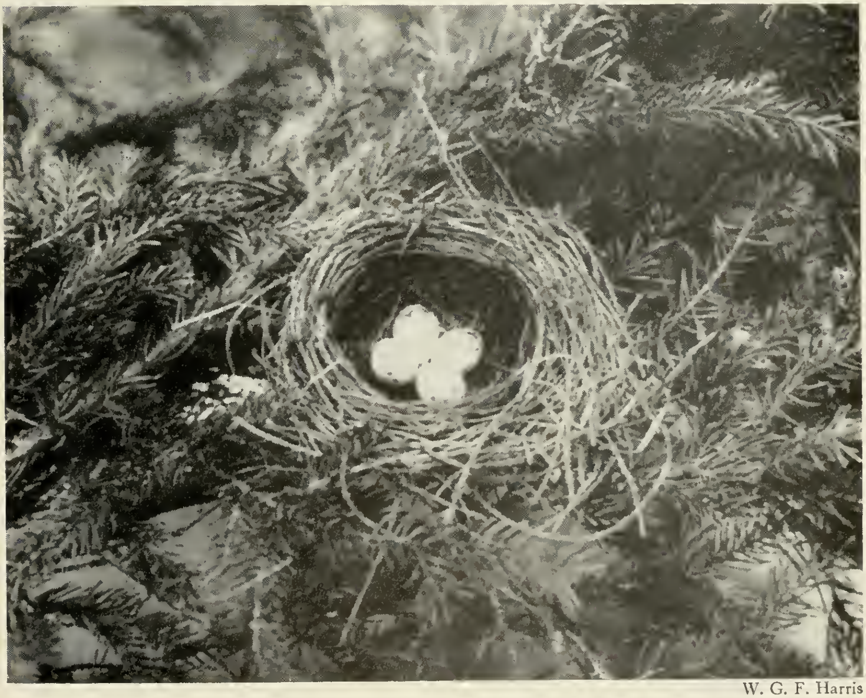


Carter County, Tenn., June 7, 1942 B. P. Tyler

NEST OF CHESTNUT-SIDED WARBLER

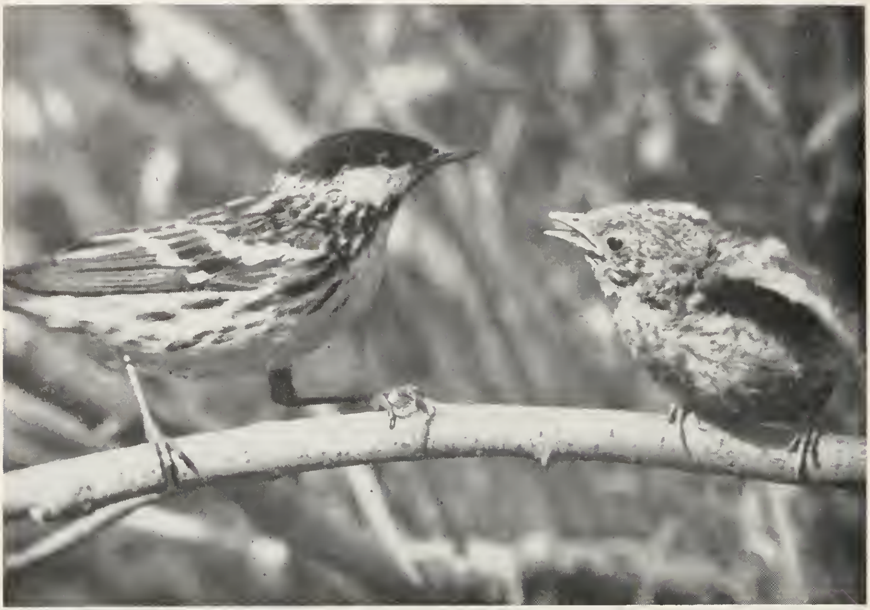


H. L. Mendall

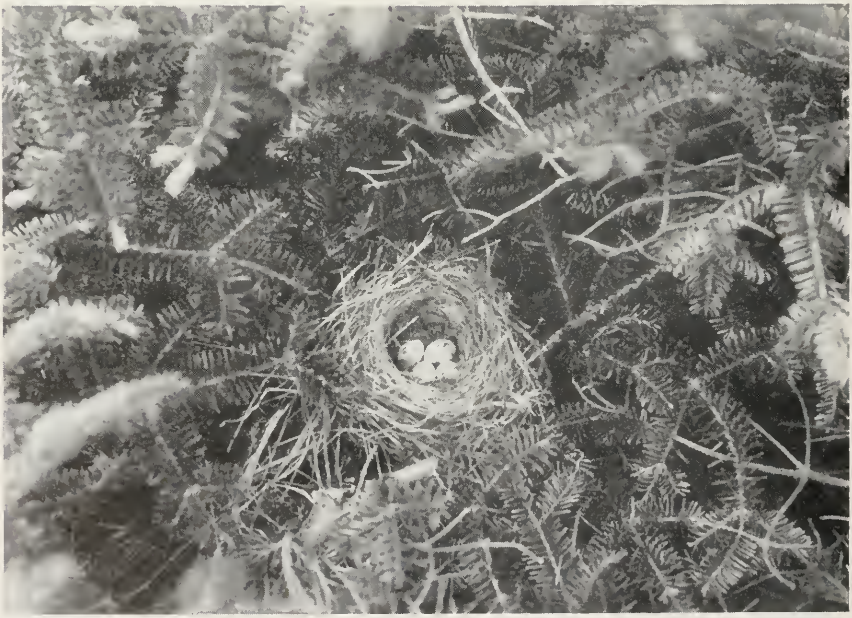


W. G. F. Harris

MALE BAY-BREASTED WARBLER AND NEST

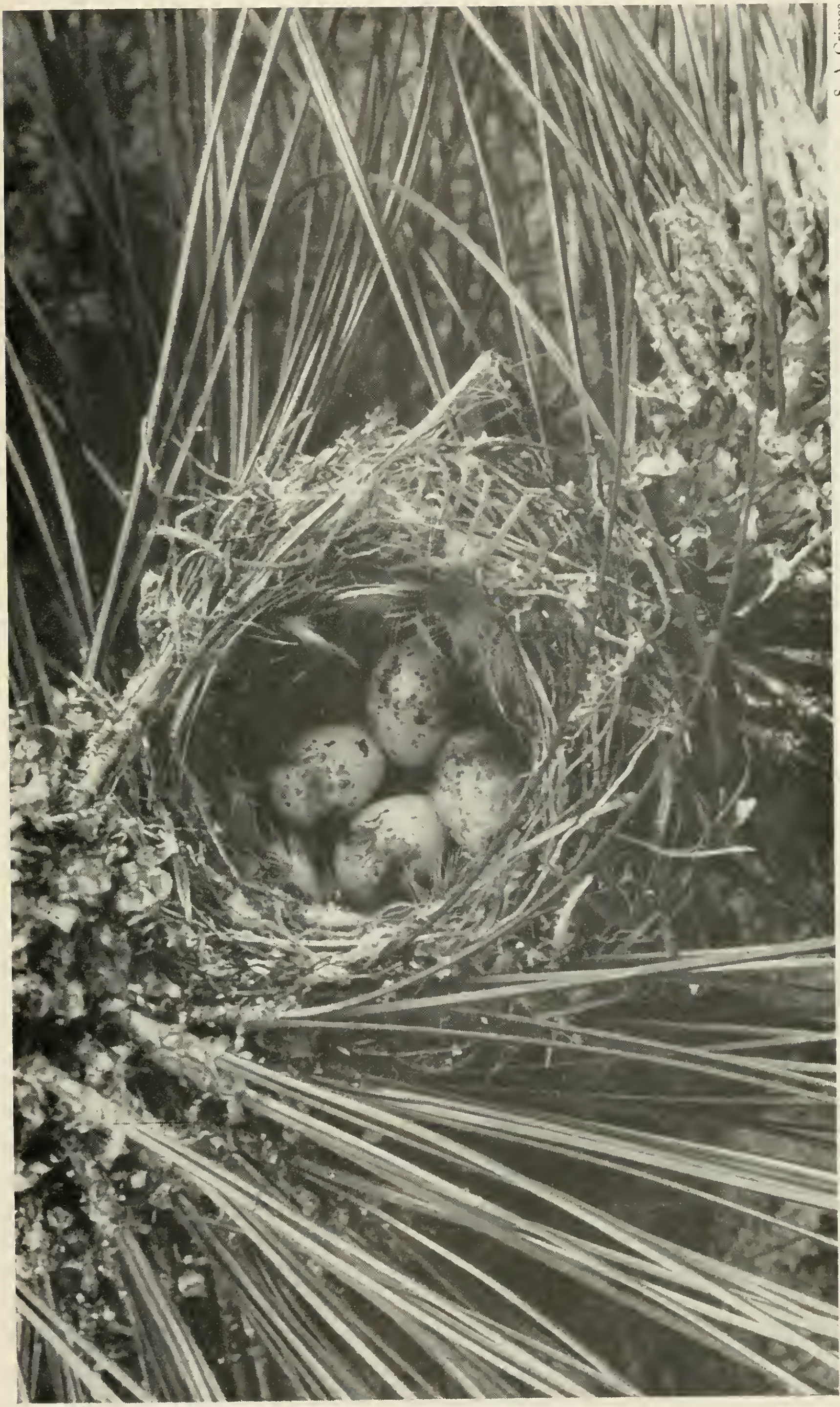


Torbay, Newfoundland, July 12, 1943 W. H. Carrick



Magdalen Islands, Quebec B. S. Bowdish

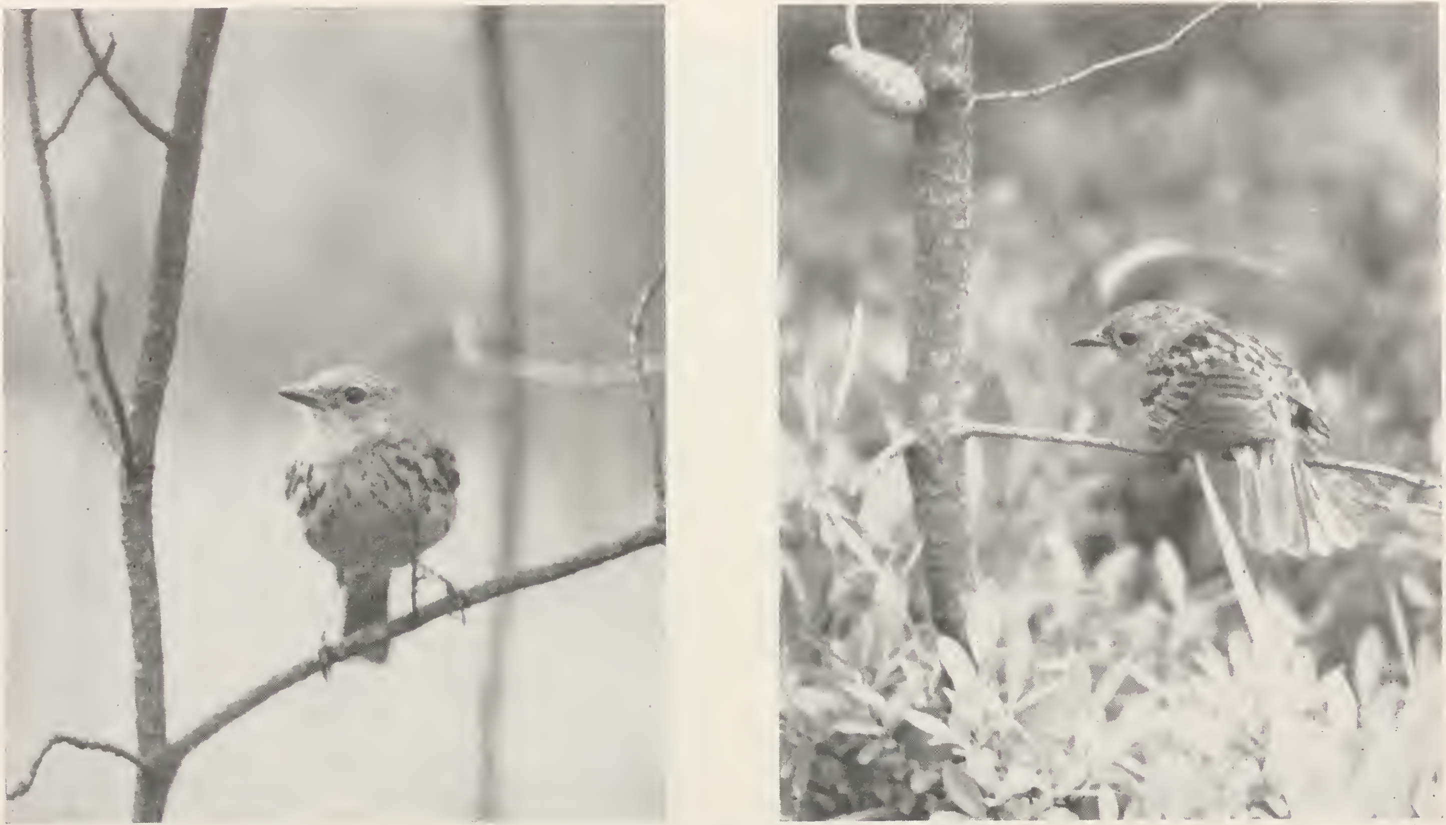
BLACK-POLLED WARBLERS, ADULT MALE AND YOUNG, AND NEST



S. A. Grimes

Duval County, Fla., May 11, 1930

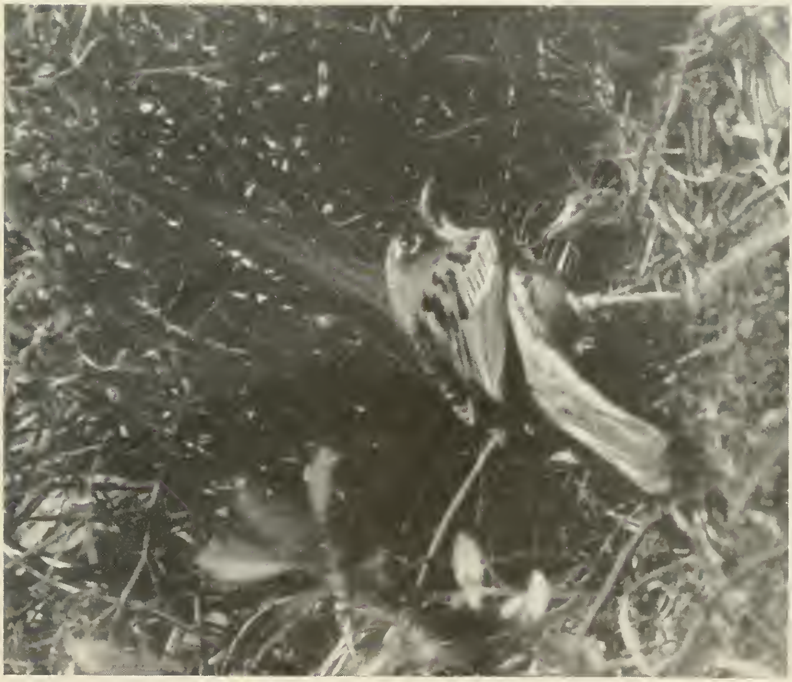
FLORIDA PINE WARBLER'S NEST



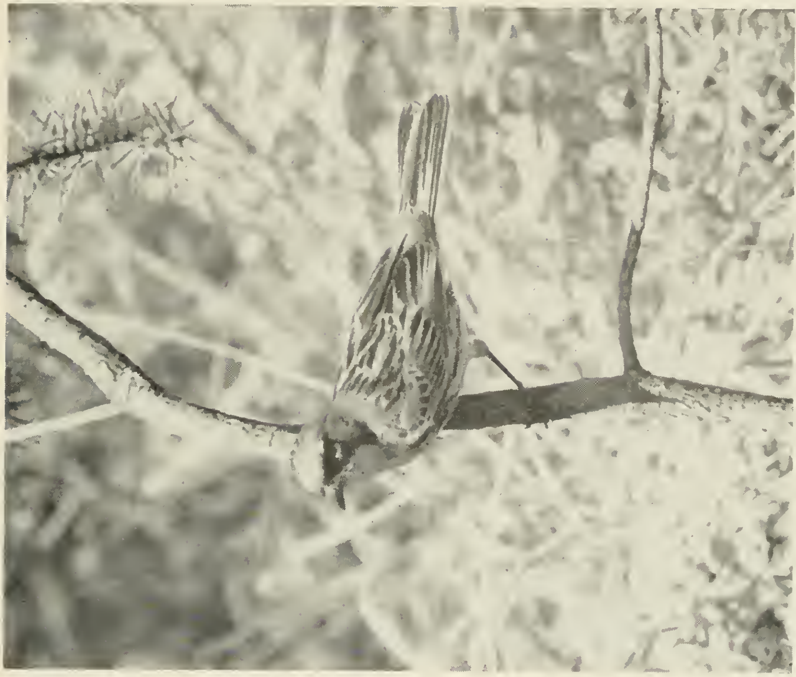
Crawford County, Mich., June 24, 1938 L. H. Walkinshaw

Oscoda County, Mich., June 23, 1932 L. H. Walkinshaw

KIRTLAND'S WARBLER, FEMALES

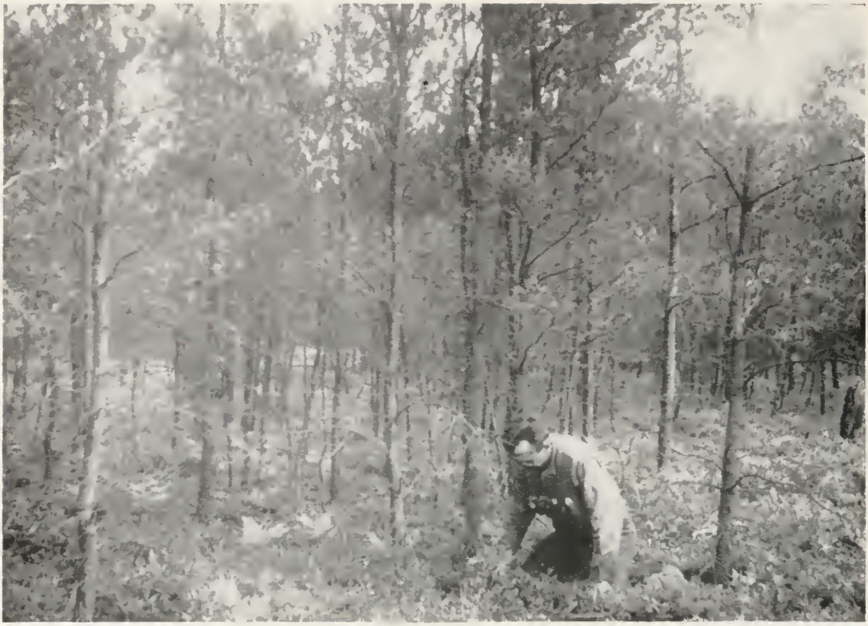


Crawford County, Mich., June 19, 1944 B. W. Baker

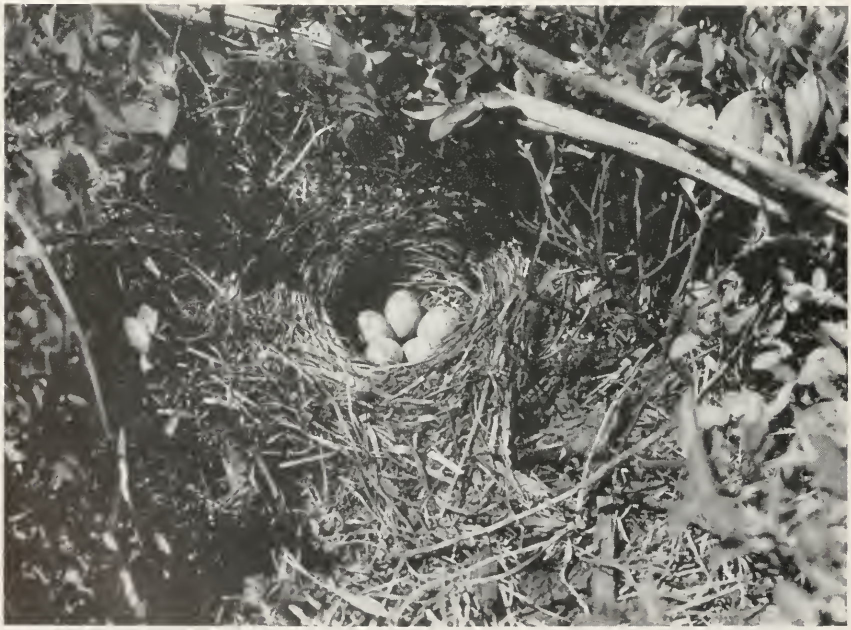


Crawford County, Mich., July 21, 1944 L. H. Walkinshaw

KIRTLAND'S WARBLER, MALES

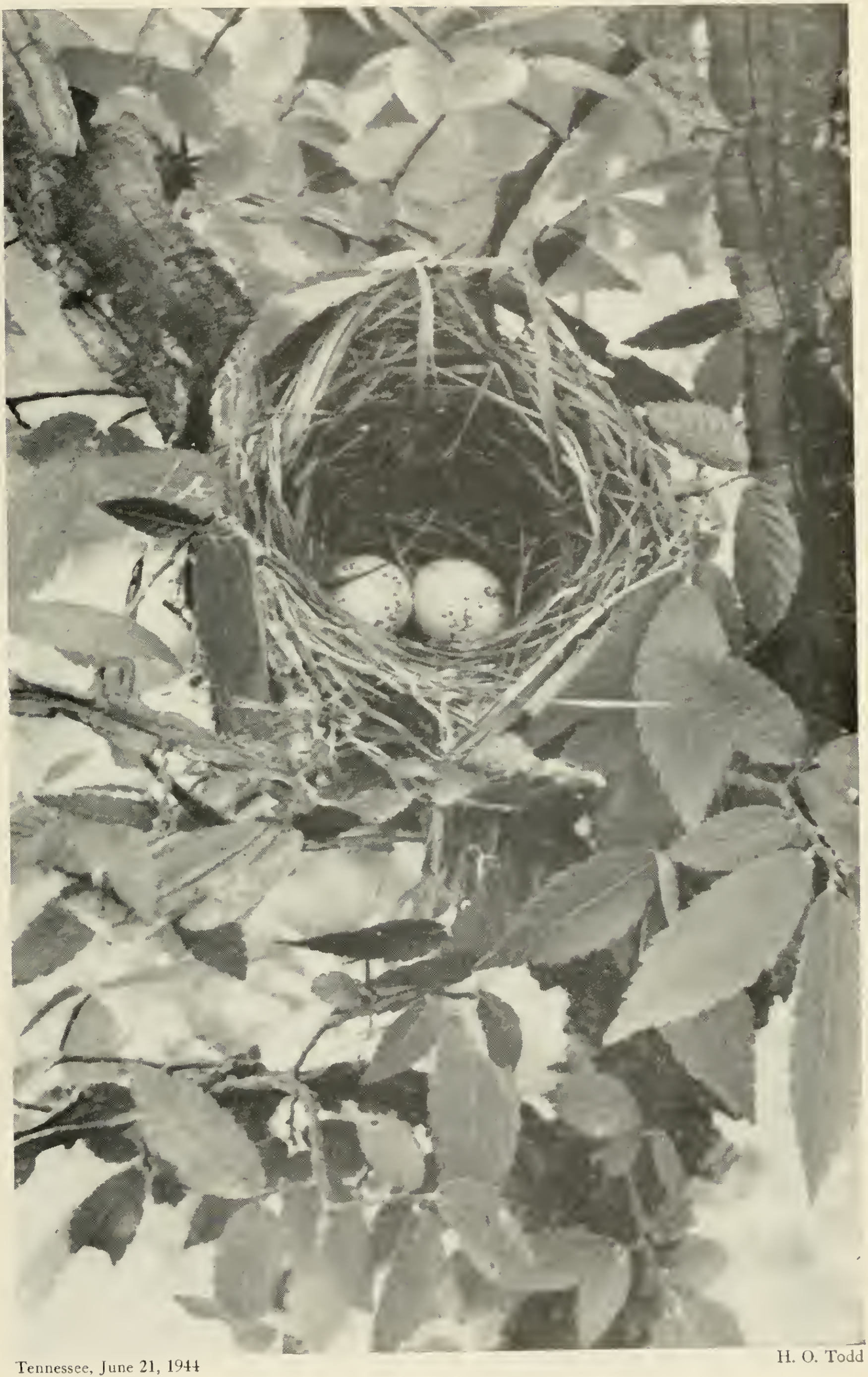


Montmorency County, Mich., June 16, 1936 Josselyn Van Tyne



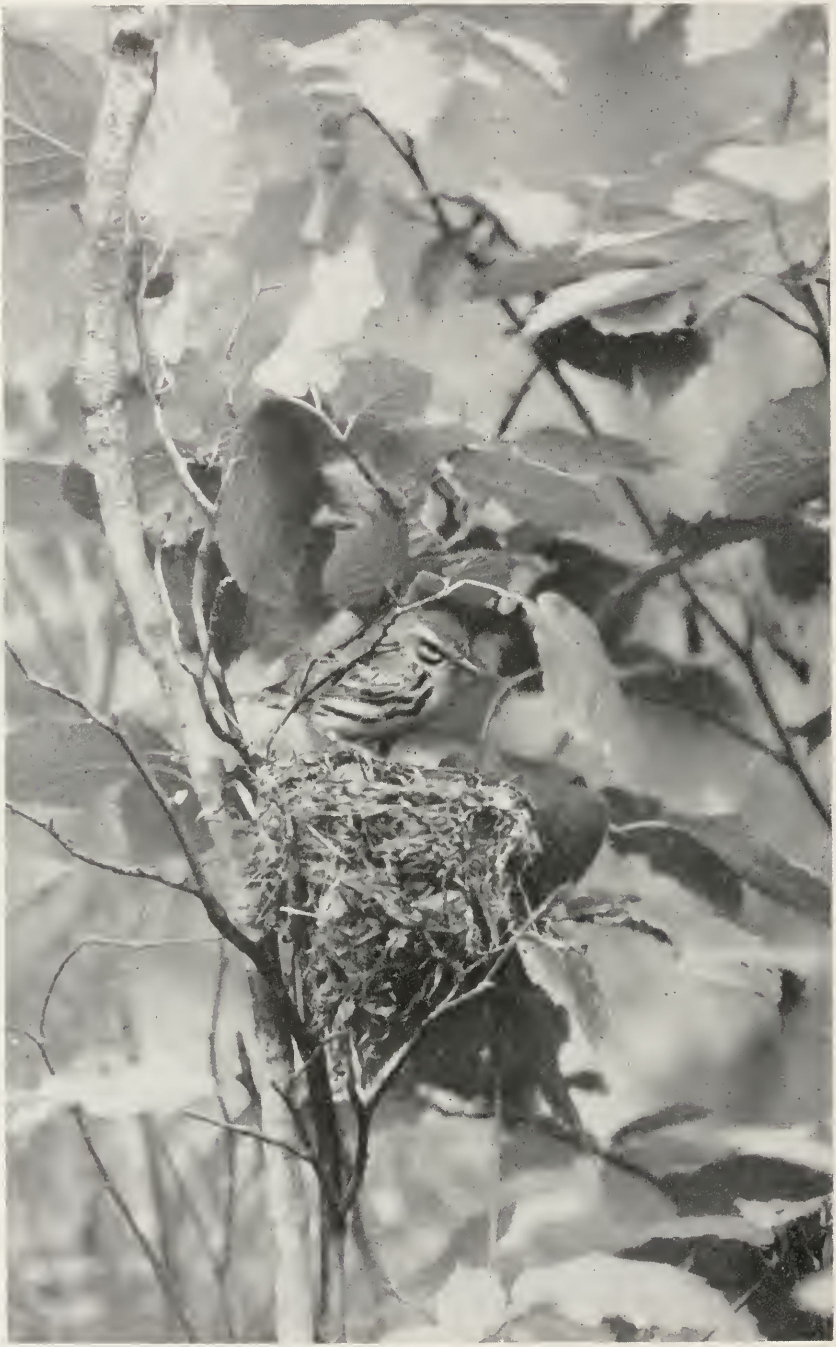
Michigan, July 4, 1941 E. M. Brigham, Jr.

NESTING SITE AND NEST OF KIRTLAND'S WARBLER



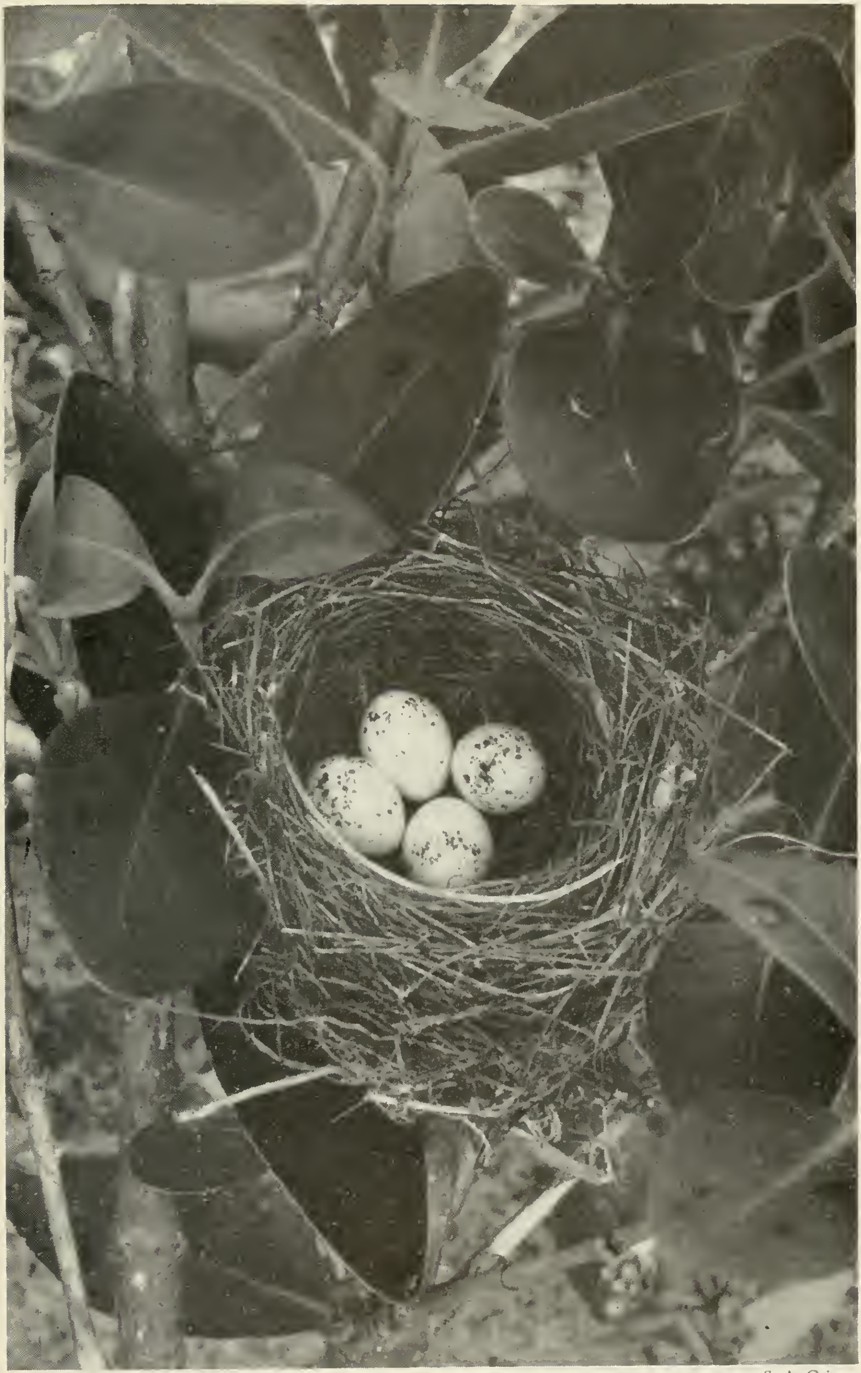
Tennessee, June 21, 1944 H. O. Todd

NEST OF NORTHERN PRAIRIE WARBLER
(In winged elm, 42 inches from ground)



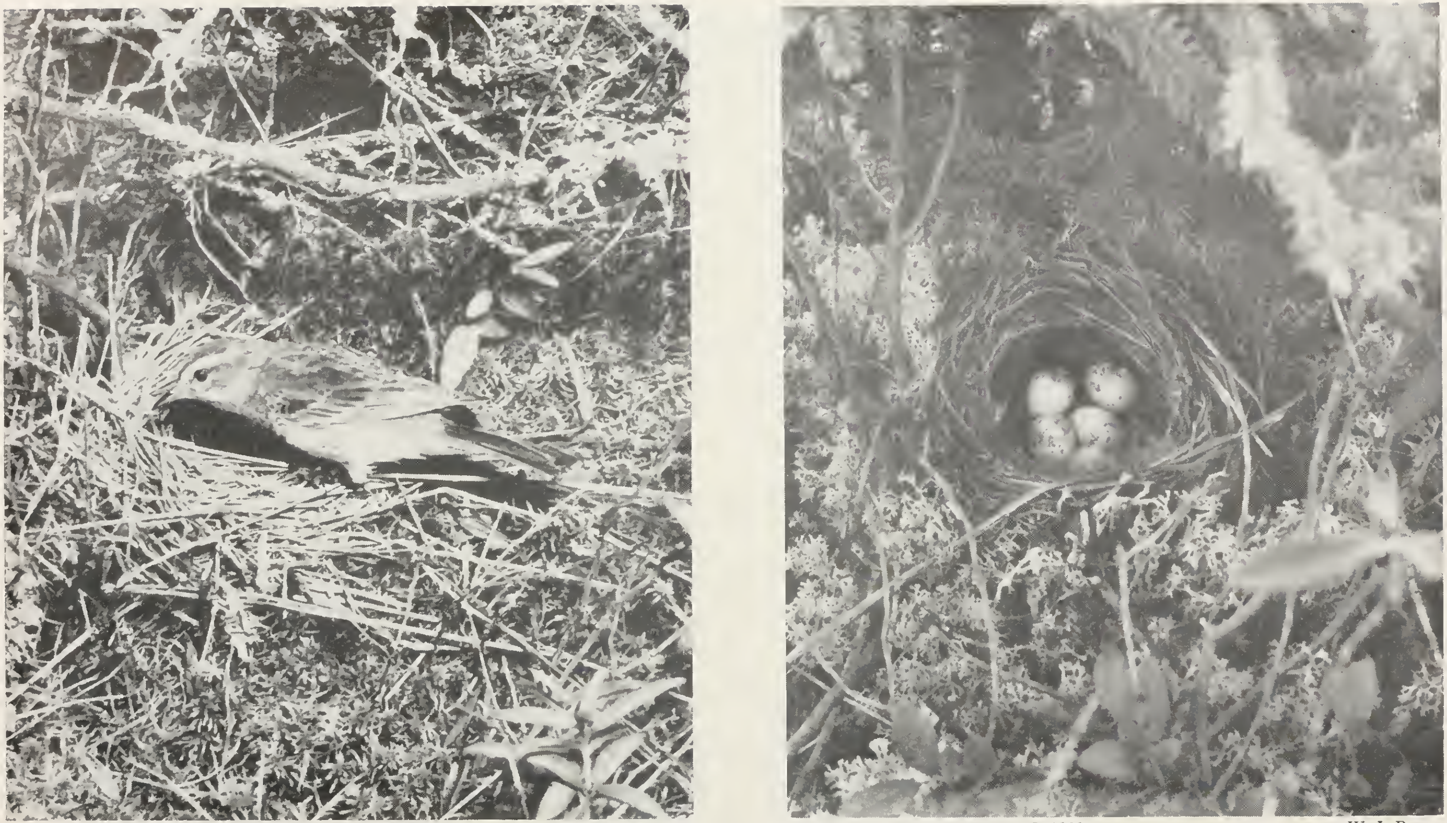
Crawford County, Mich., June 18, 1944 L. H. Walkinshaw

NORTHERN PRAIRIE WARBLER



St. Johns County, Fla., June 12, 1922 S. A. Grimes

FLORIDA PRAIRIE WARBLER'S NEST IN A BLACK MANGROVE

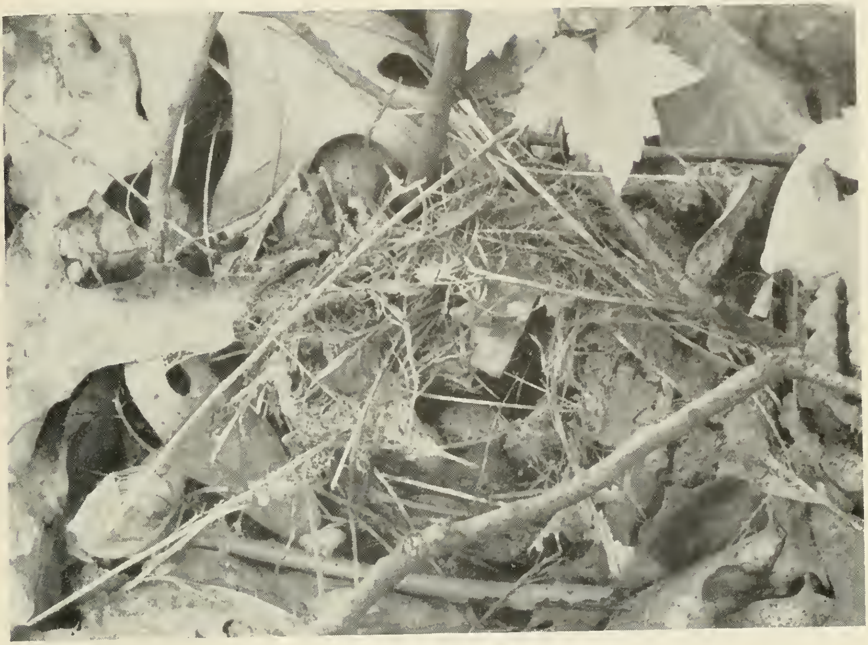


W. V. Crich

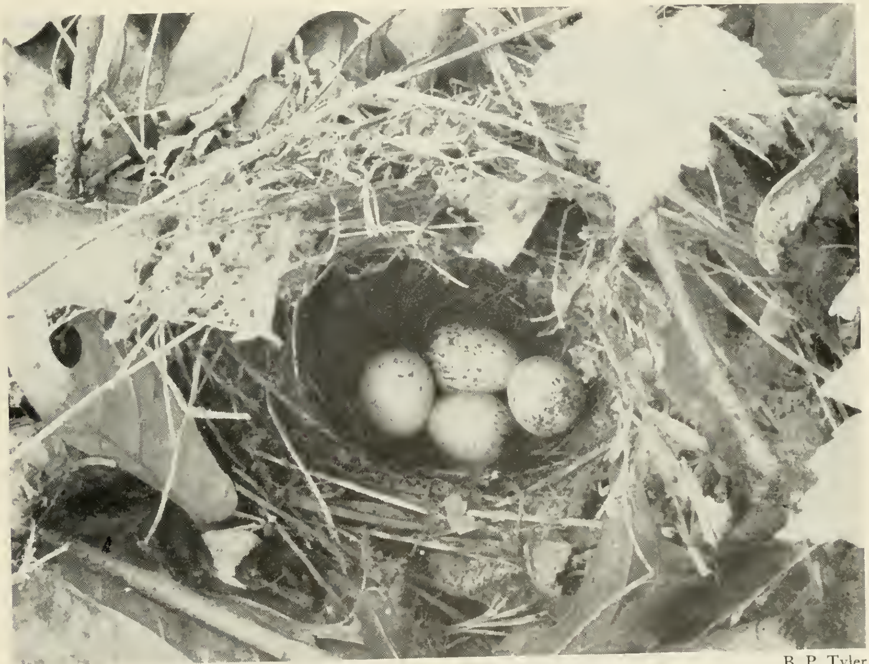
Matane County, Quebec, June 15, 1939

W. J. Brown

WESTERN PALM WARBLER (LEFT) AND NEST OF YELLOW PALM WARBLER (RIGHT)



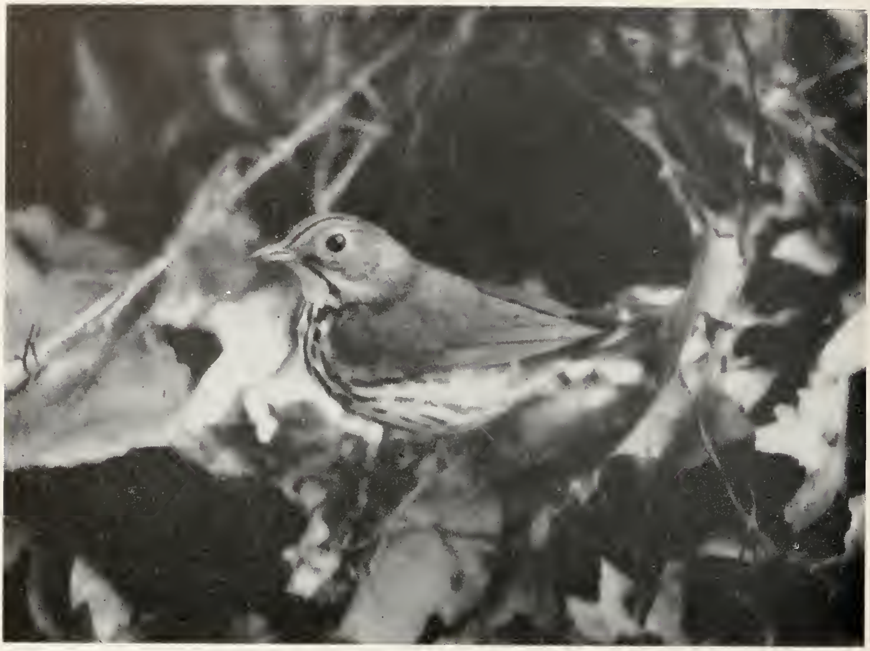
Nest as originally found

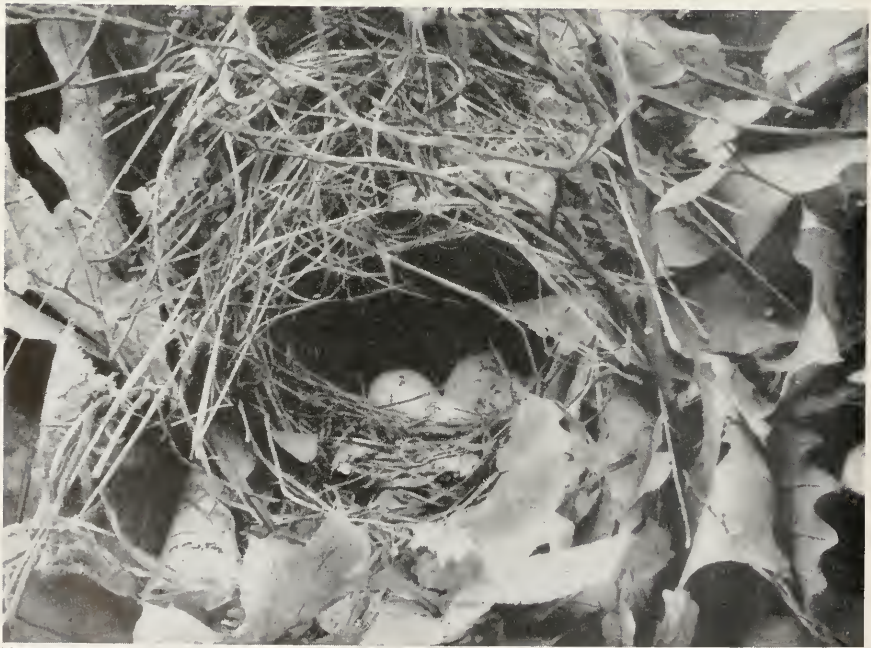


Johnson City, Tenn., May 16, 1943 B. P. Tyler

Nest opened (note cowbird egg)

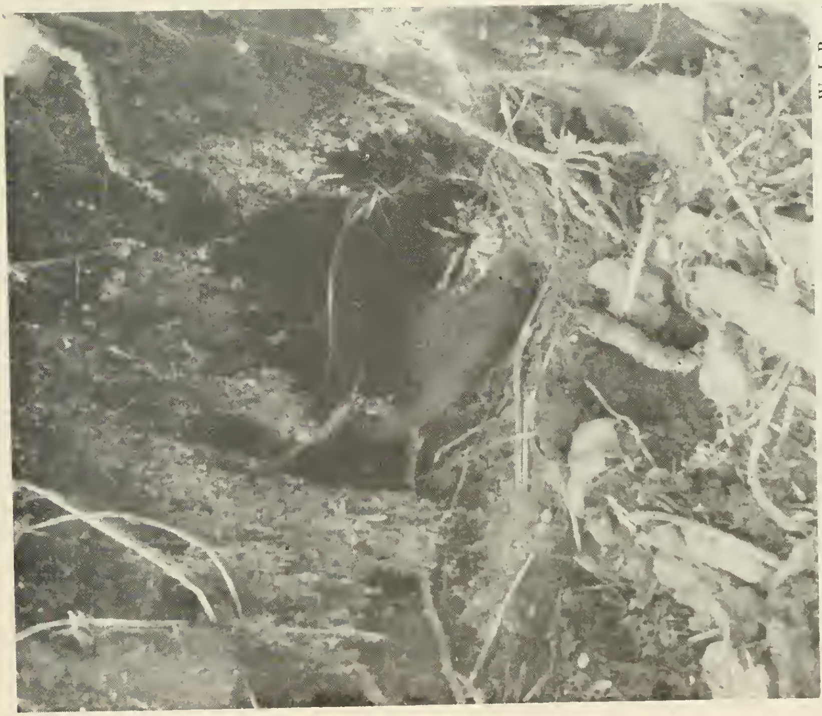
NEST OF EASTERN OVENBIRD



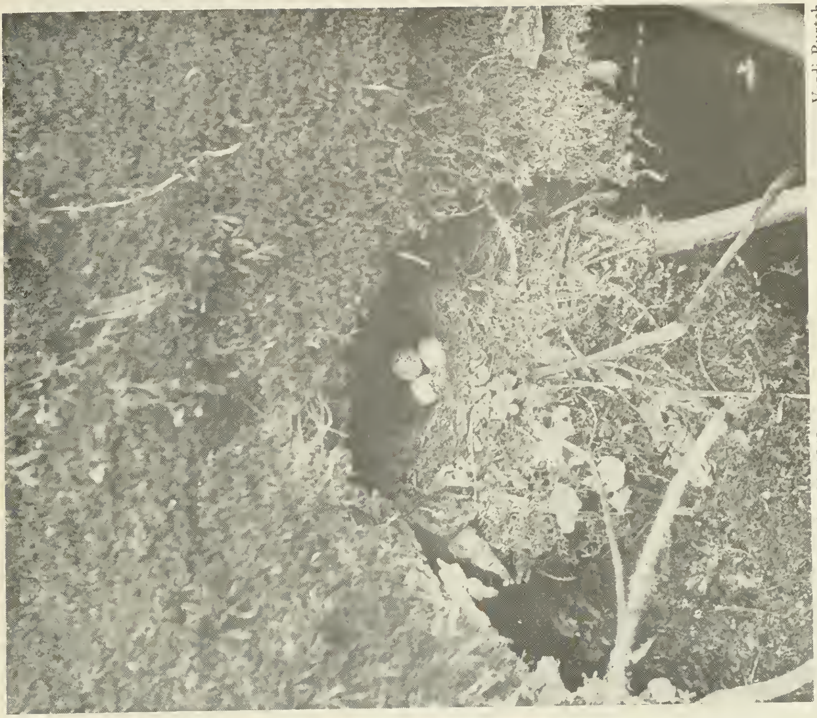


Yorktown Heights, N. Y., July 1924 A. O. Gross

EASTERN OVENBIRD AND NEST

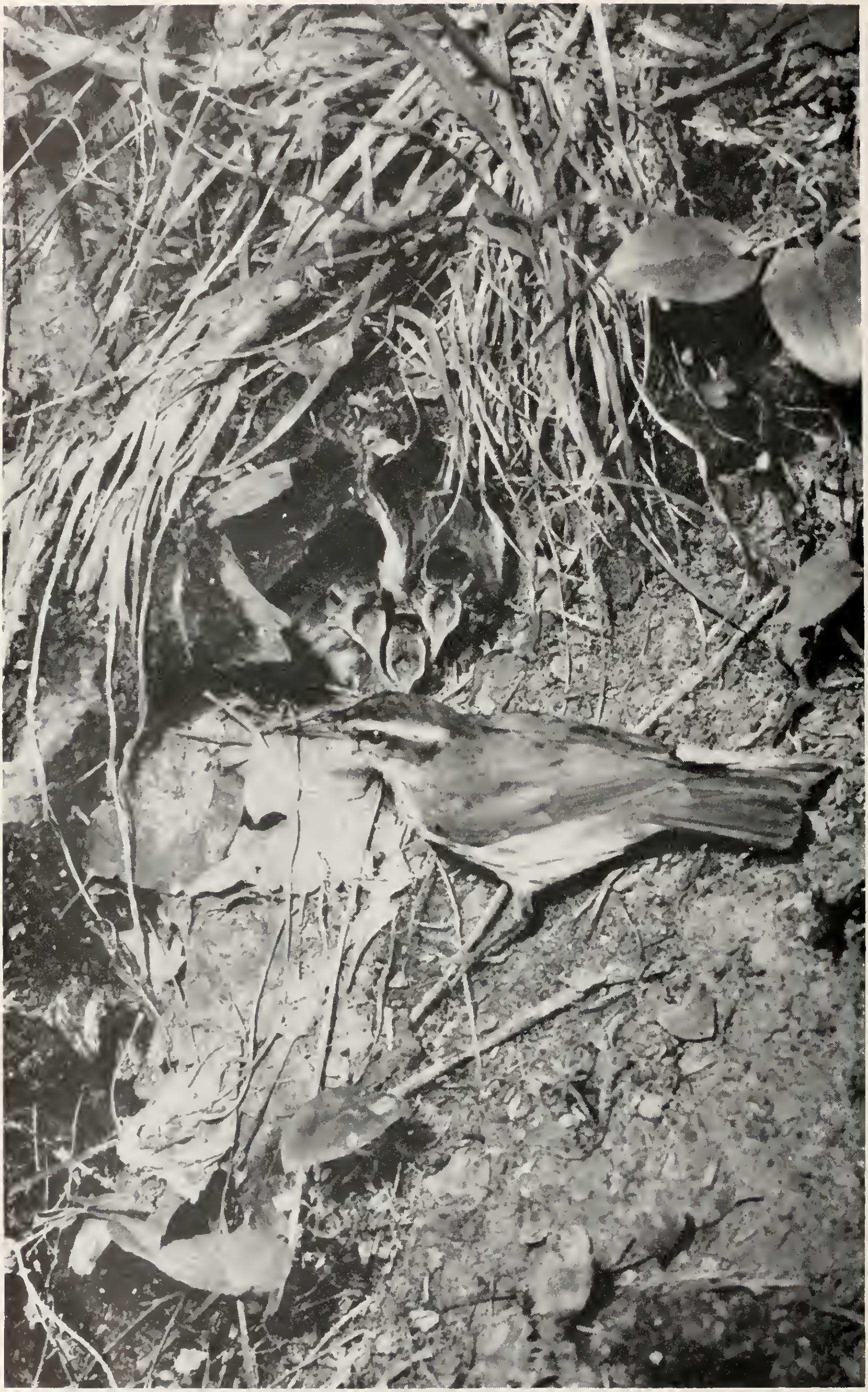


Matane County, Quebec, June 1925 W. J. Brown



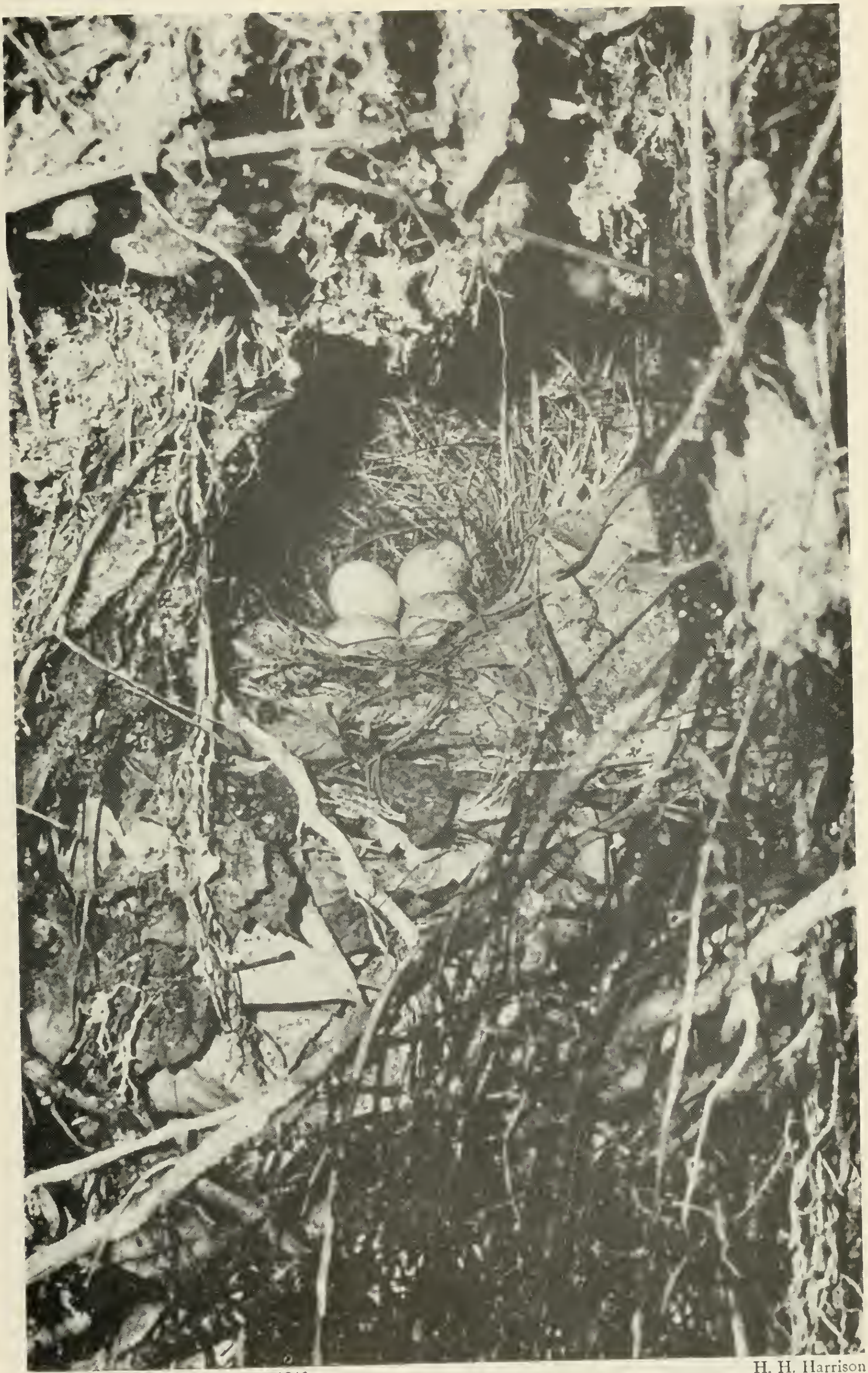
Potter Swamp, N. Y., May 23, 1909 Verdi Burtch

NORTHERN SMALL-BILLED WATERTHRUSH AND NEST



Leechburg, Pa., June 19, 1943 H. H. Harrison

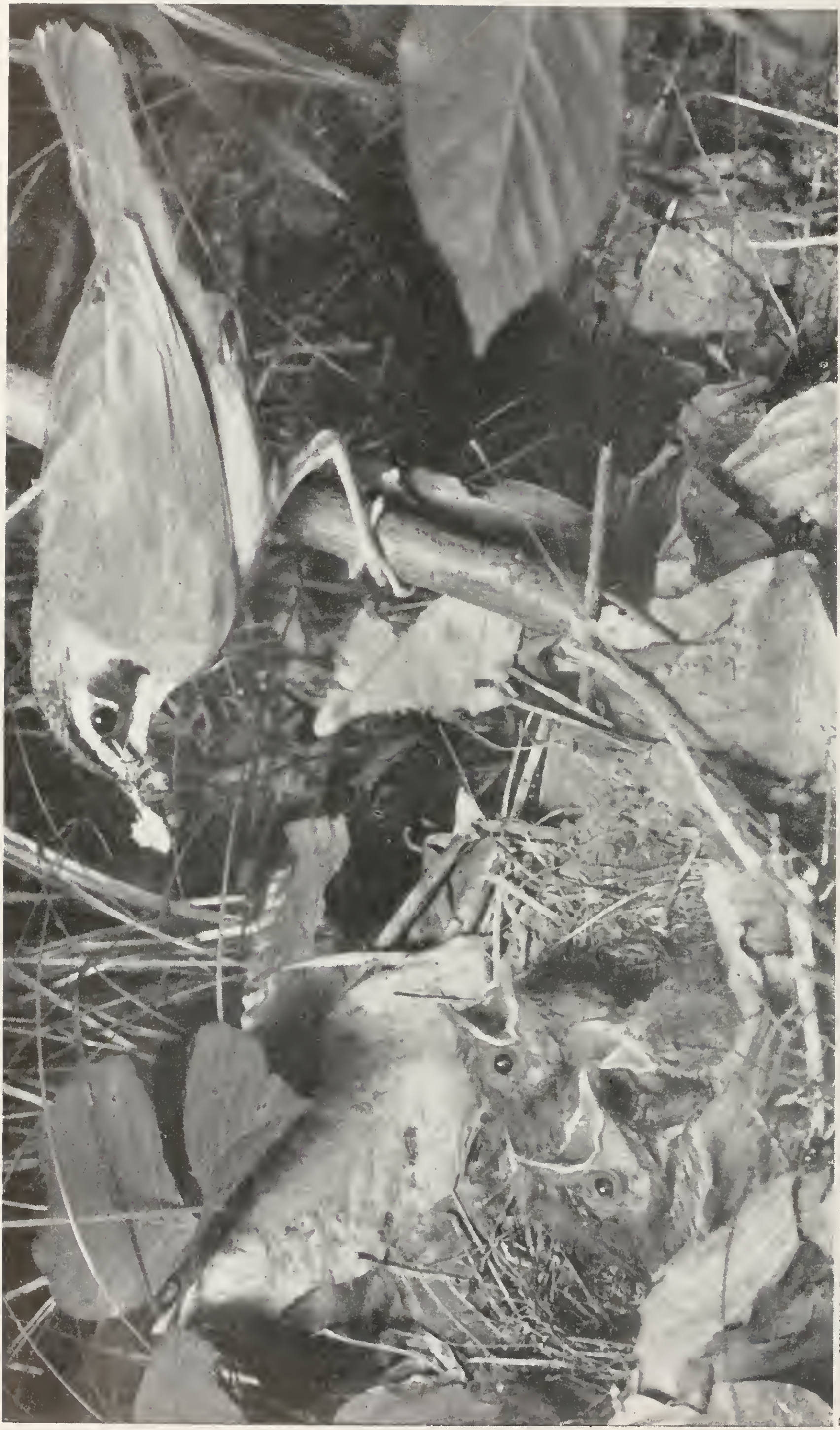
LOUISIANA WATERTHRUSH



Armstrong County, Pa., May 20, 1943

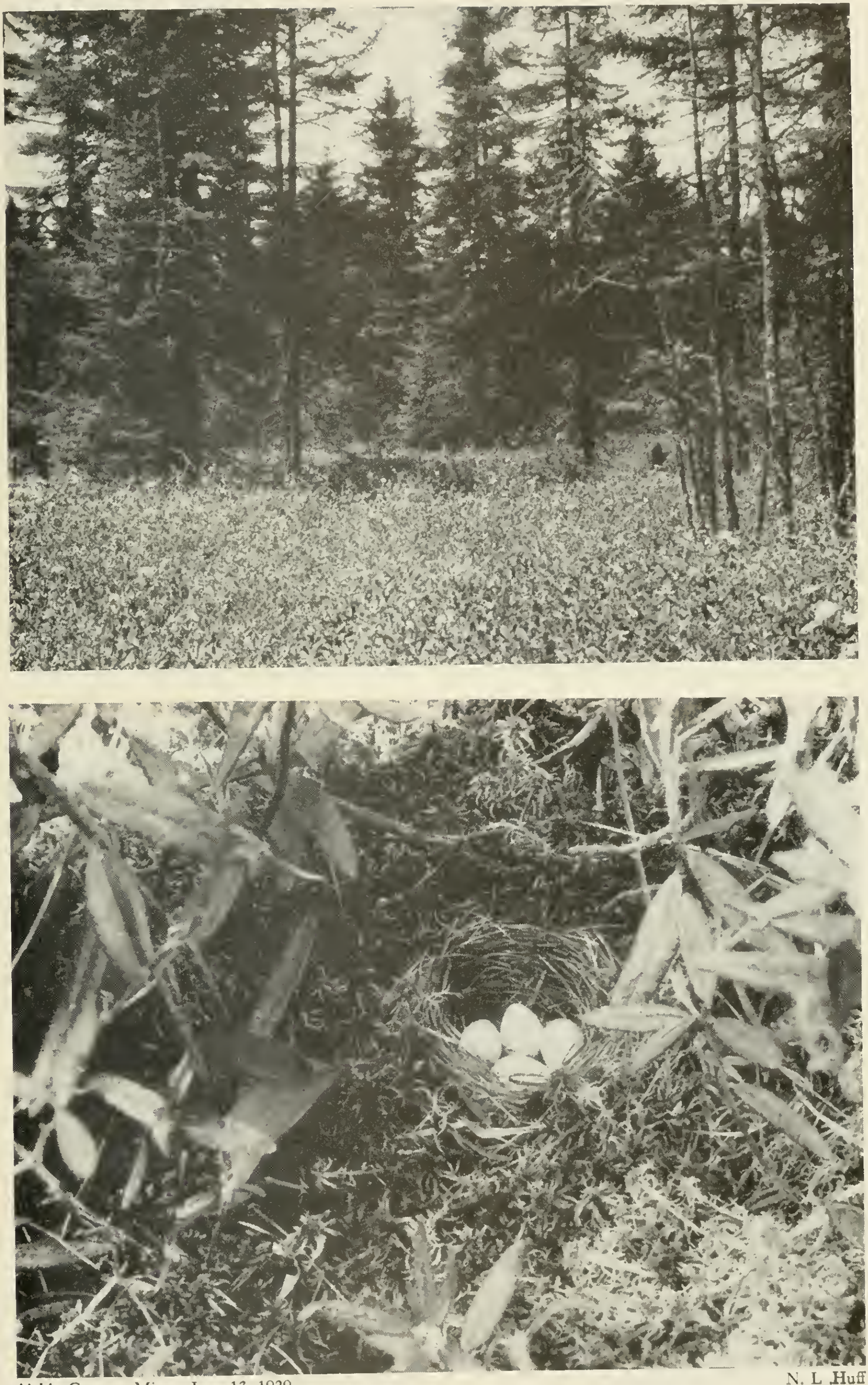
H. H. Harrison

NEST OF LOUISIANA WATERTHRUSH



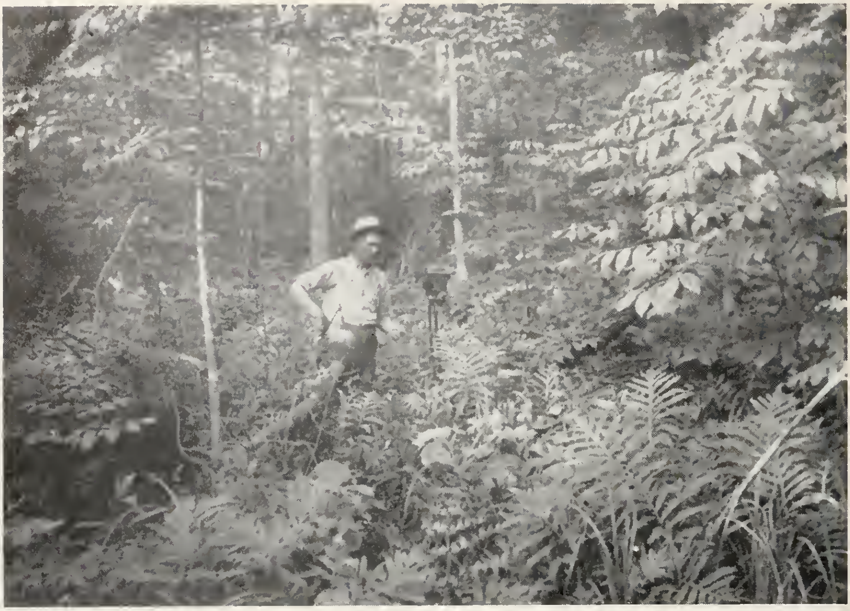
Patuxent Wildlife Research Refuge, Md., July 8, 1945 R. E. Lawrence

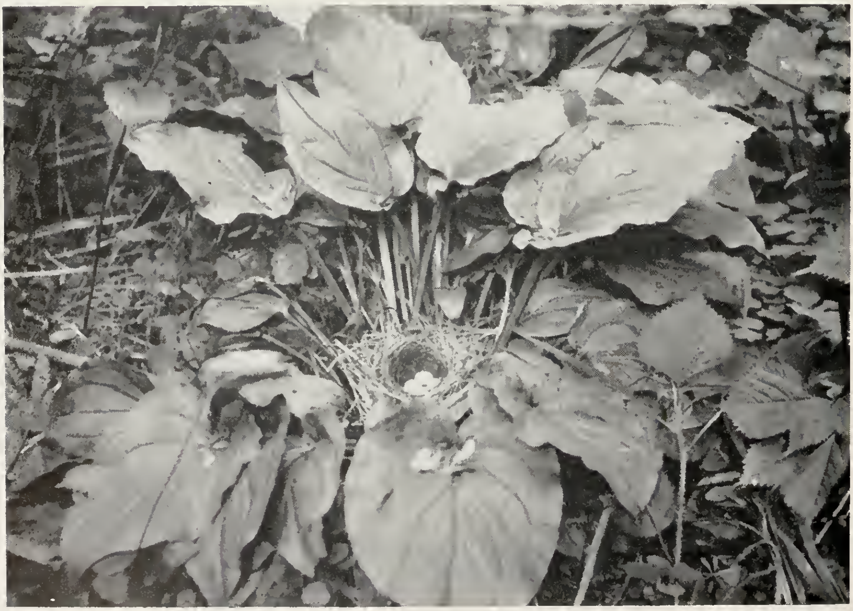
KENTUCKY WARBLER



Aitkin County, Minn., June 13, 1929 N. L. Huff

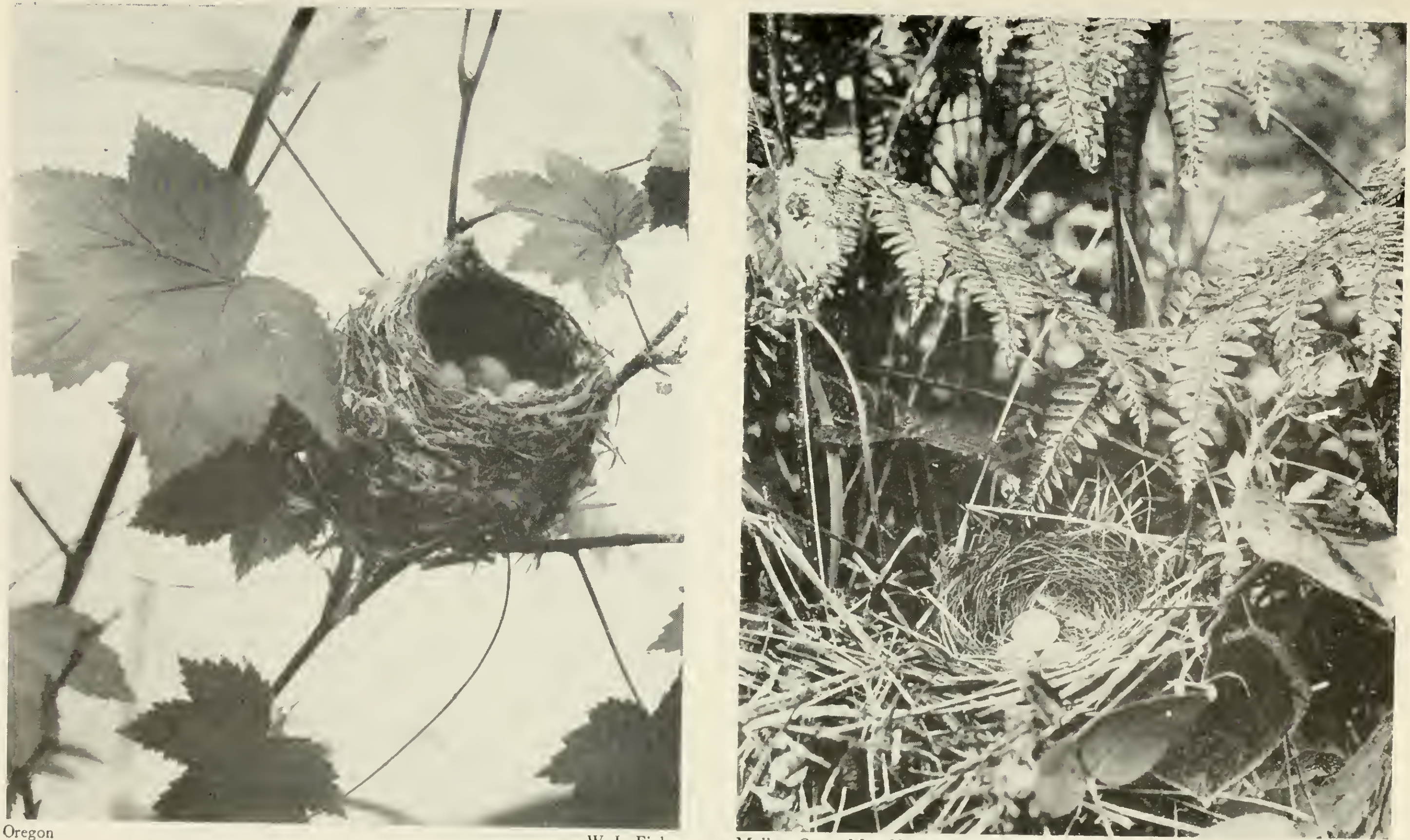
HABITAT AND NEST OF CONNECTICUT WARBLER





Yates County, N. Y., June 7, 1908 Verdi Burtch

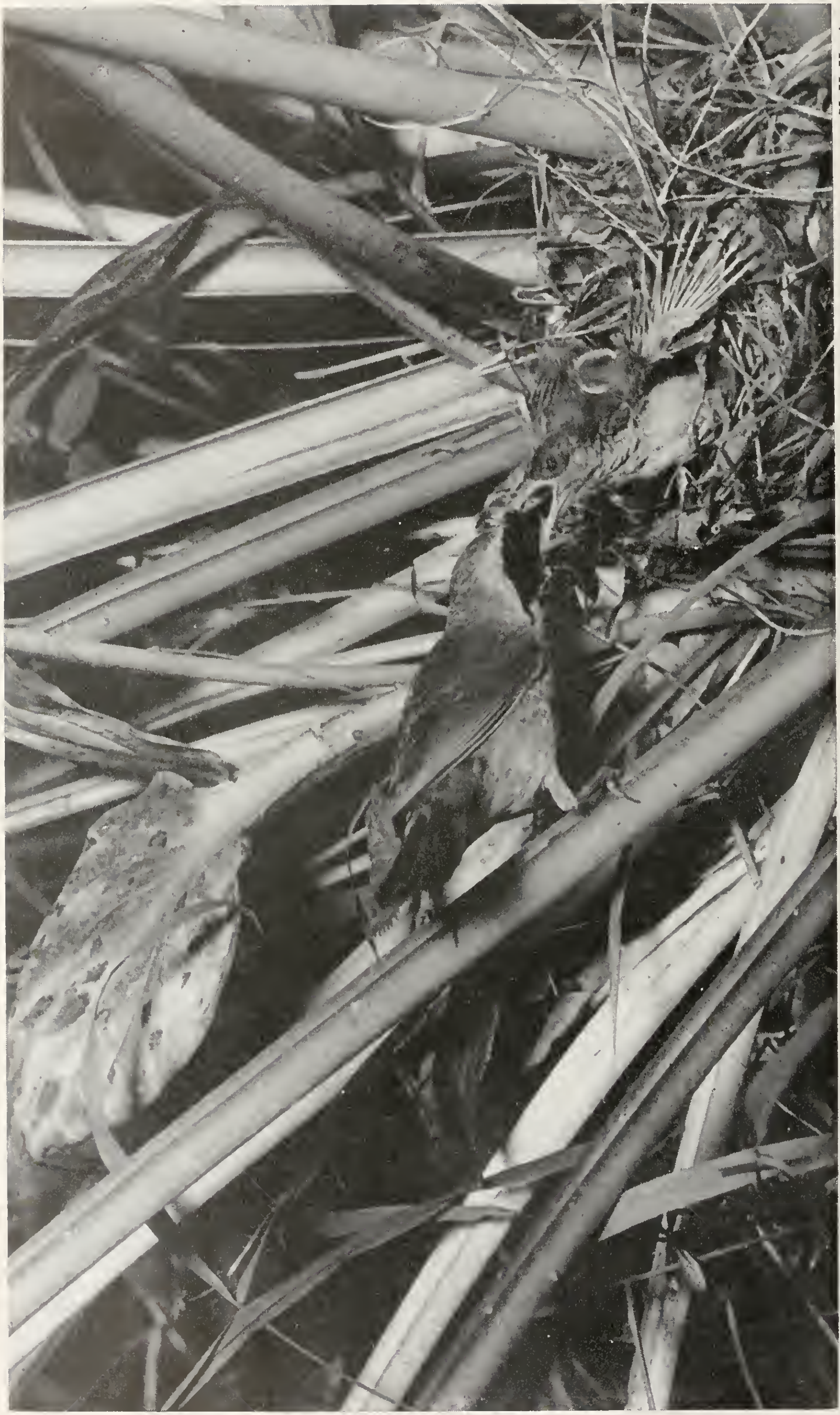
NESTING SITE AND NEST OF MOURNING WARBLER



Oregon W. L. Finley

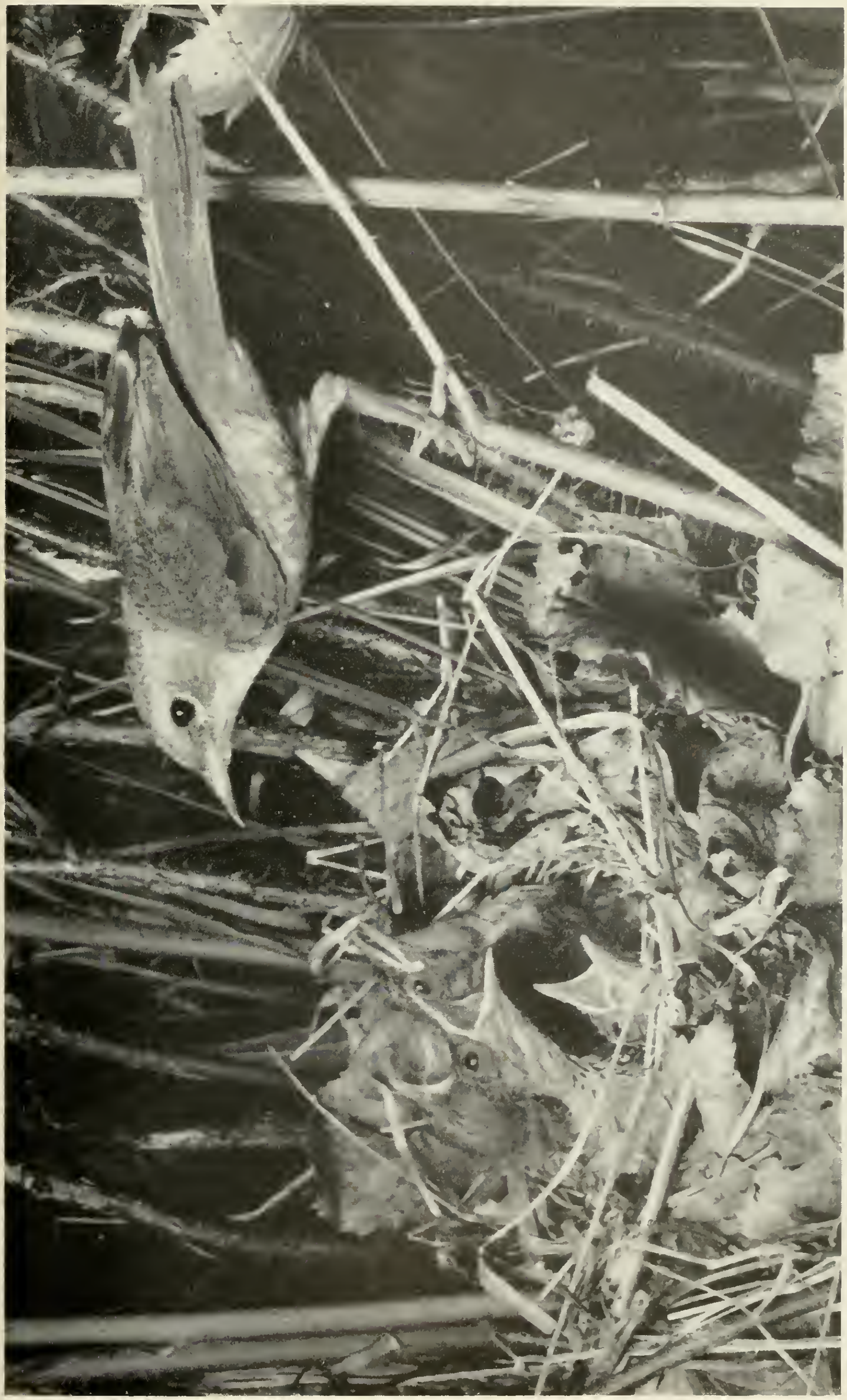
Mulino, Oreg., May 29, 1912 A. Walker

NESTS OF NORTHERN MACGILLIVRAY'S WARBLER



Pymatuning, Pa., June 10, 1944 H. H. Harrison

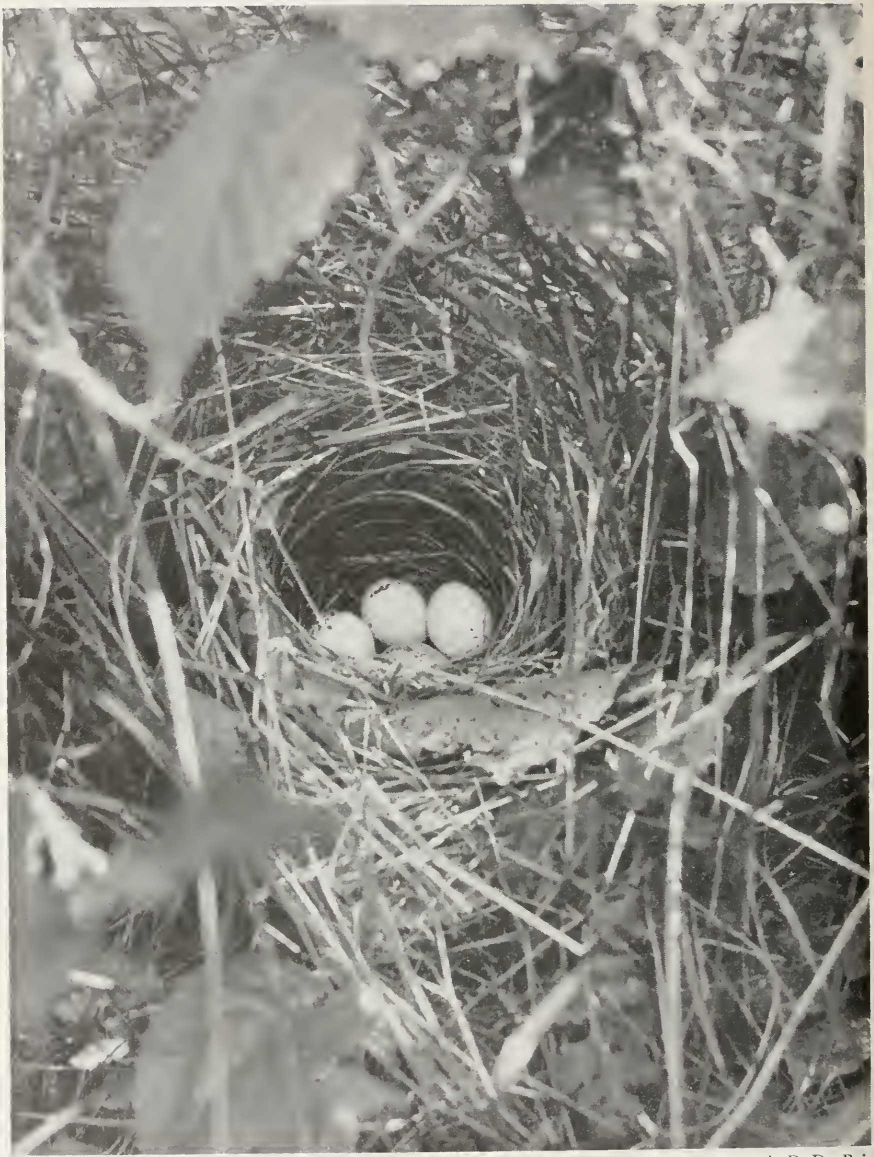
NORTHERN YELLOWTHROAT, MALE



Maine, 1945

Eliot Porter

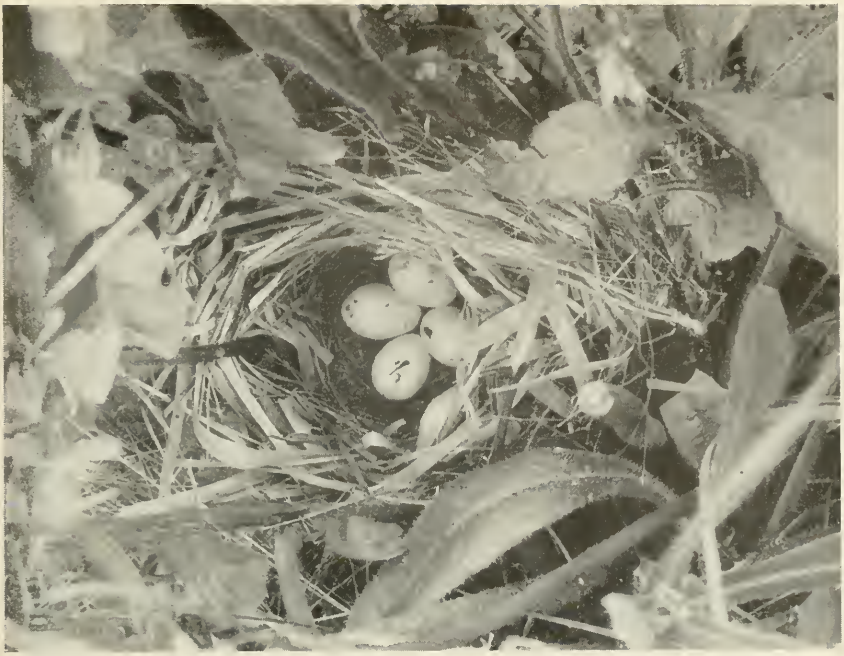
NORTHERN YELLOWTHROAT, FEMALE, WITH YOUNG



Logan County, Ill., June 6, 1913 A. D. Du Bois

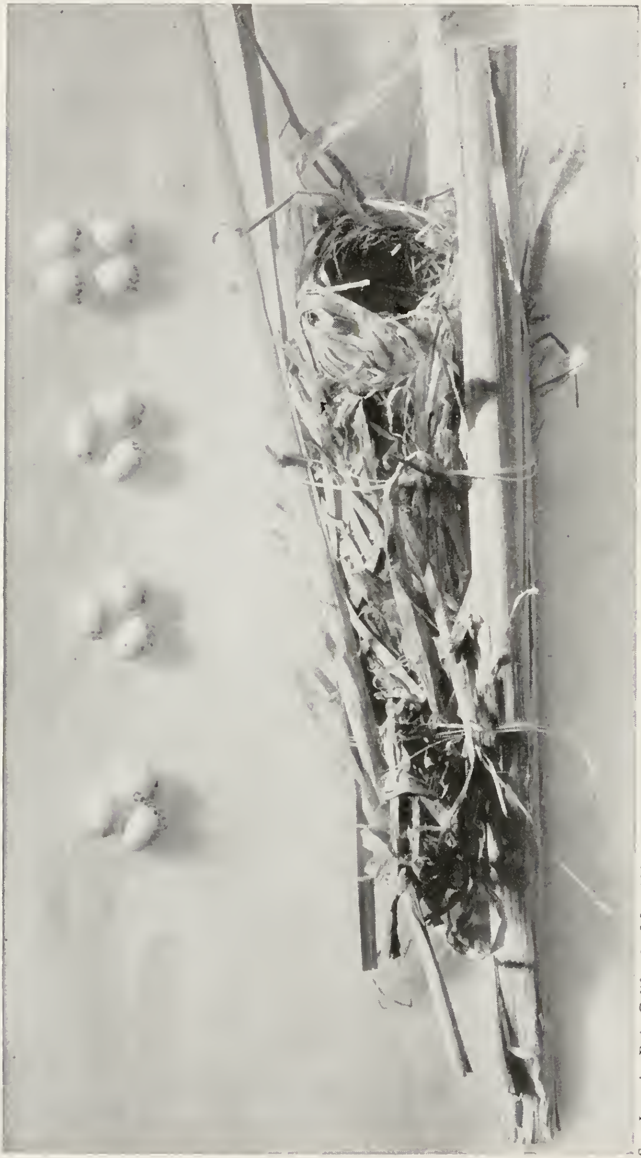
NORTHERN YELLOWTHROAT'S NEST
(One cowbird egg showing)

Duval County, Fla., May 22, 1932 S. A. Grimes



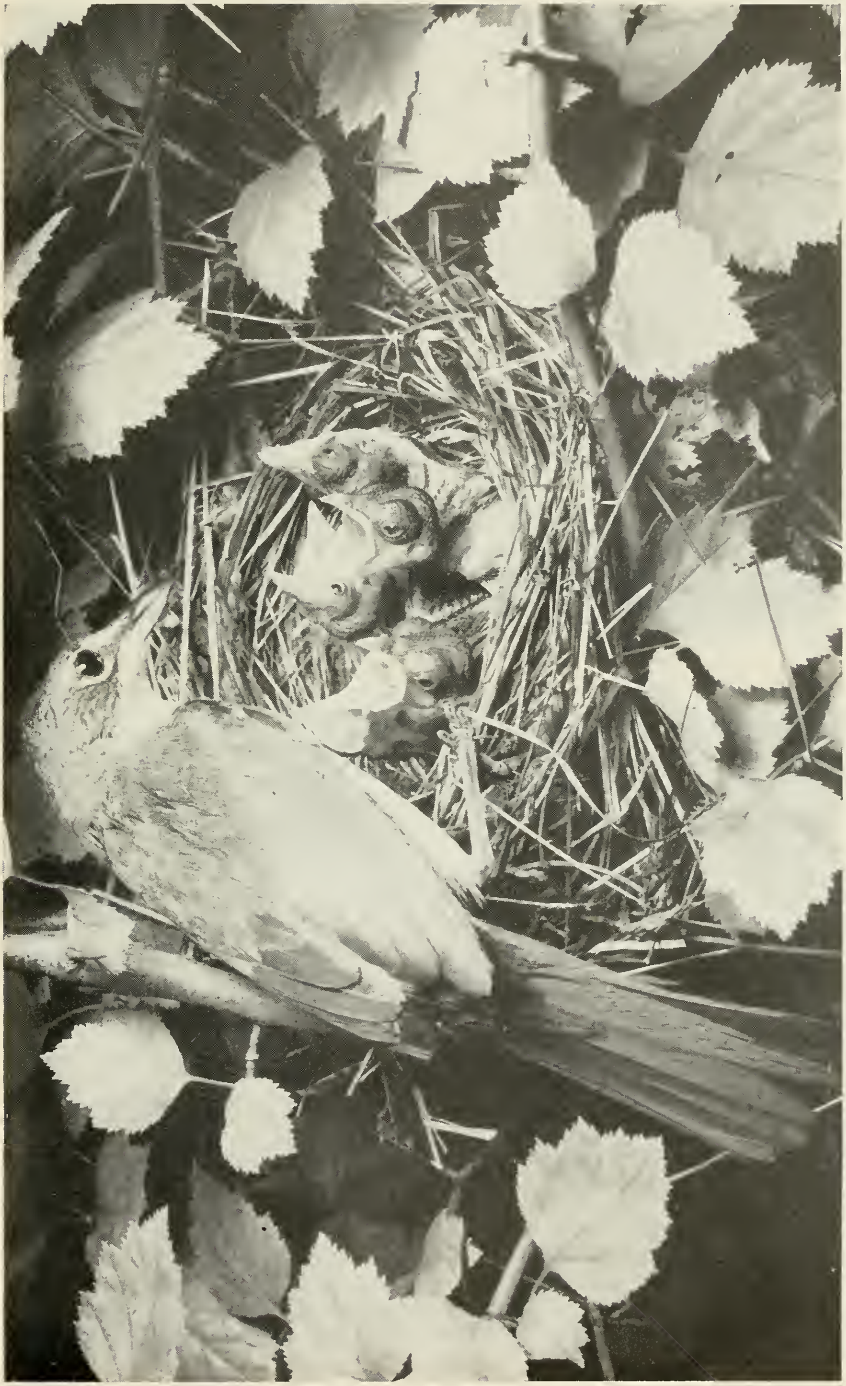
Duval County, Fla., May 4, 1932 S. A. Grimes

NESTING SITE AND NEST OF FLORIDA YELLOWTHROAT



San Ignacio, Baja California, May 1928 Griffing Bancroft (Courtesy of *The Condor*)

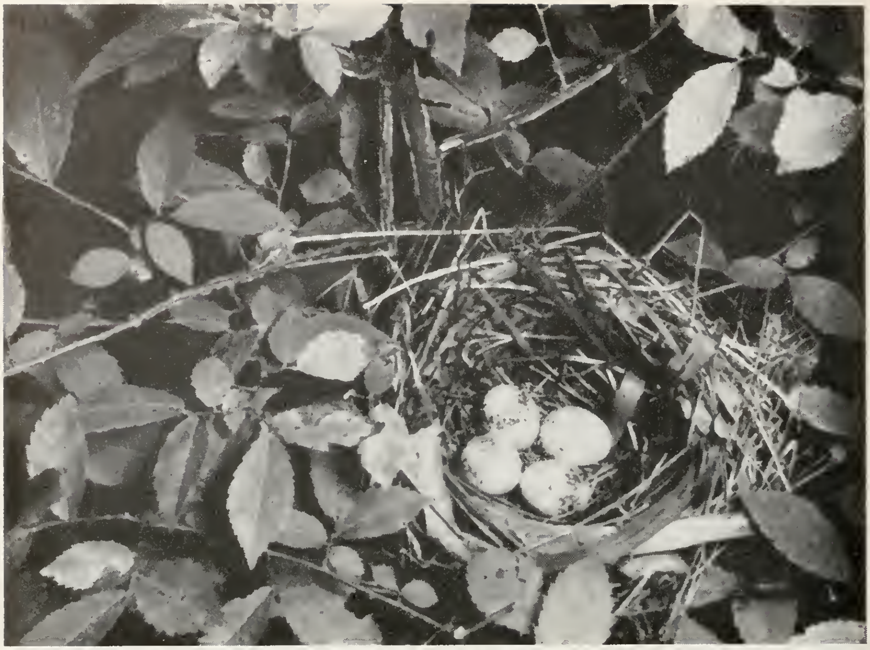
EGGS AND NEST OF GOLDMAN'S PENINSULAR YELLOWTHROAT



Eliot Porter

Illinois, June 19, 1942

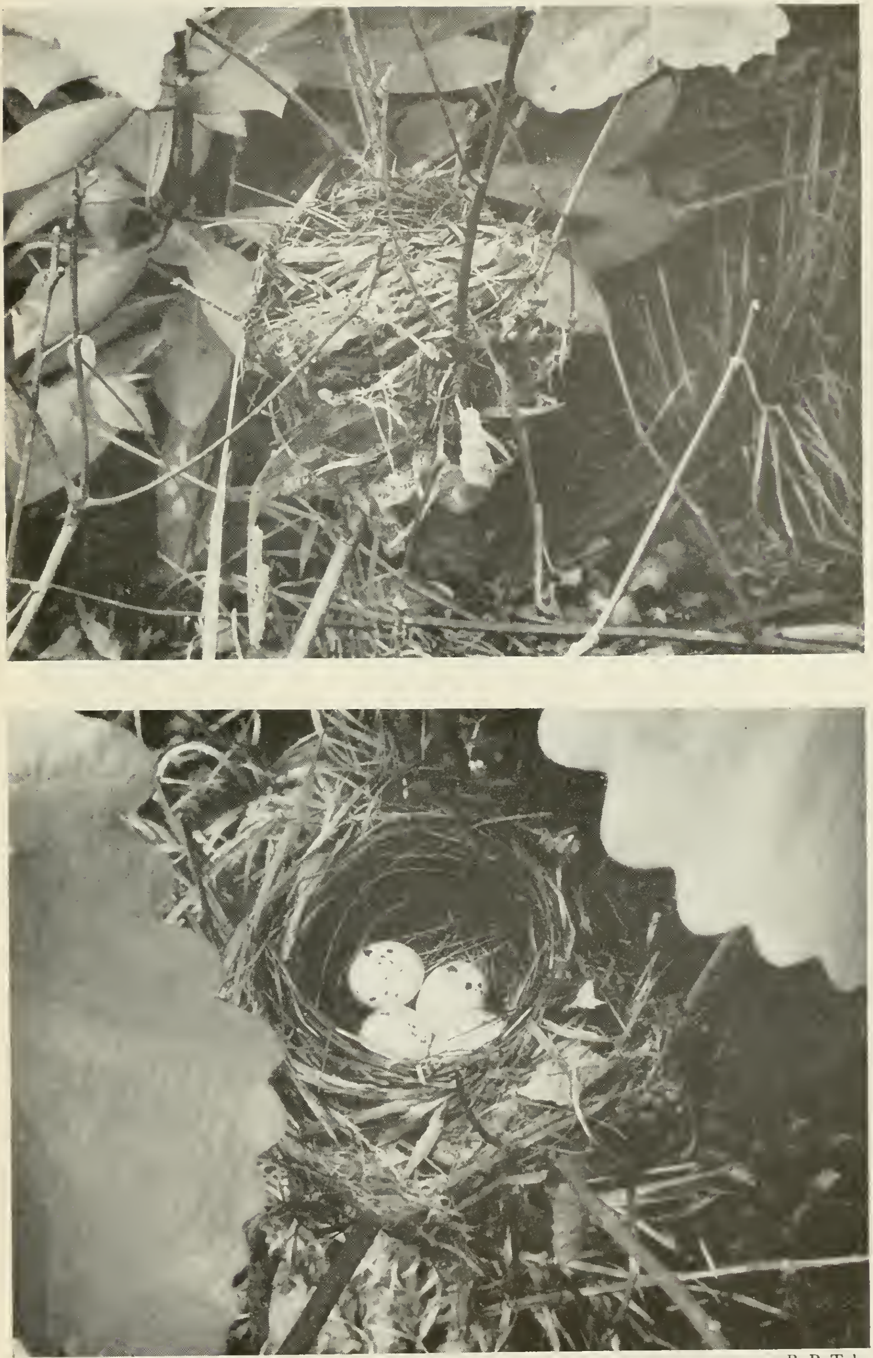
EASTERN YELLOW-BREASTED CHAT, FEMALE, WITH YOUNG



Tennessee, July 9, 1944 H. O. Todd, Jr.

Huachuca Mountains, Ariz., May 26, 1922 A. C. Bent

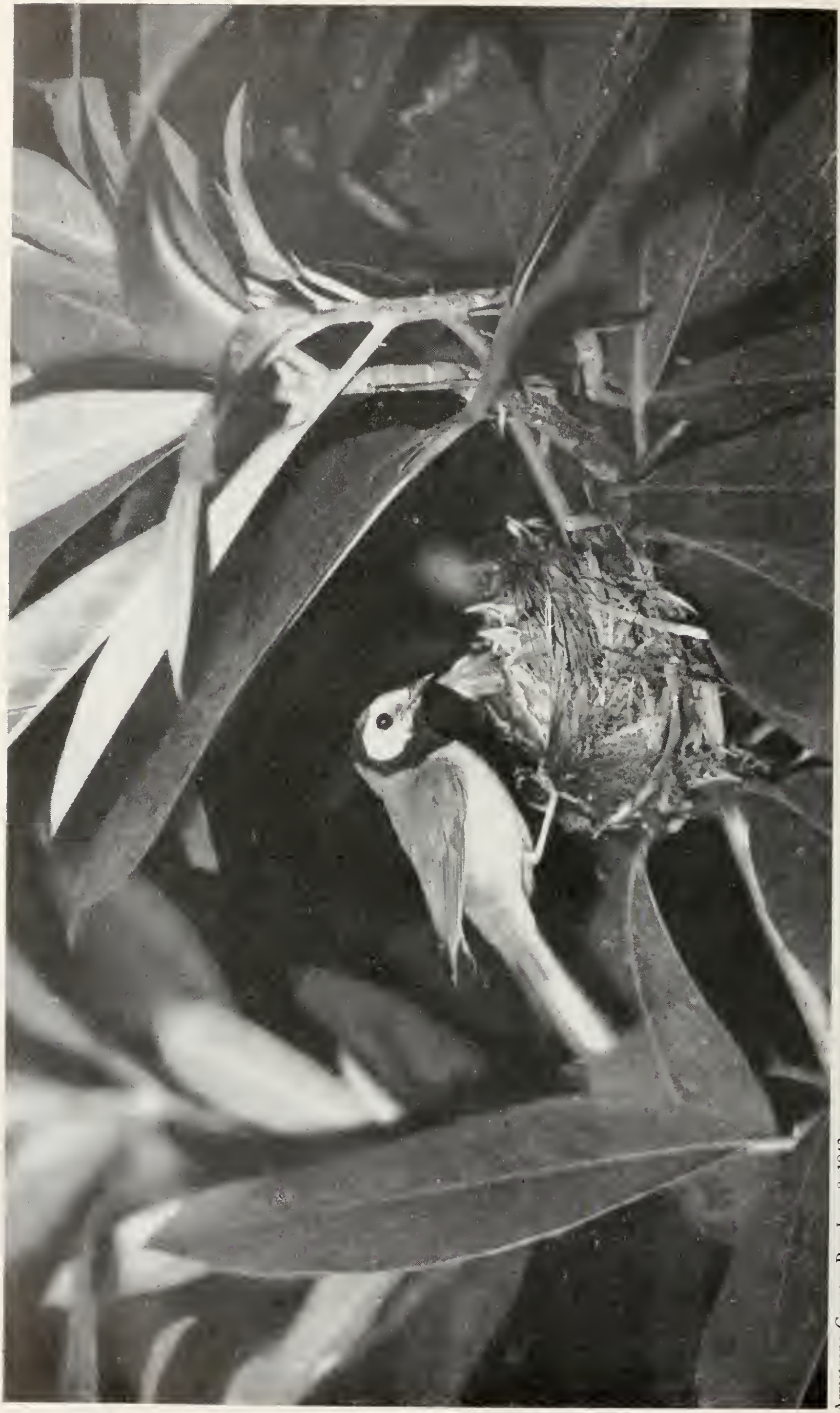
NESTS OF EASTERN YELLOW-BREASTED CHAT (UPPER) AND RED-FACED WARBLER (LOWER)



Johnson County, Tenn., June 14, 1942 B. P. Tyler

Nest of Hooded Warbler

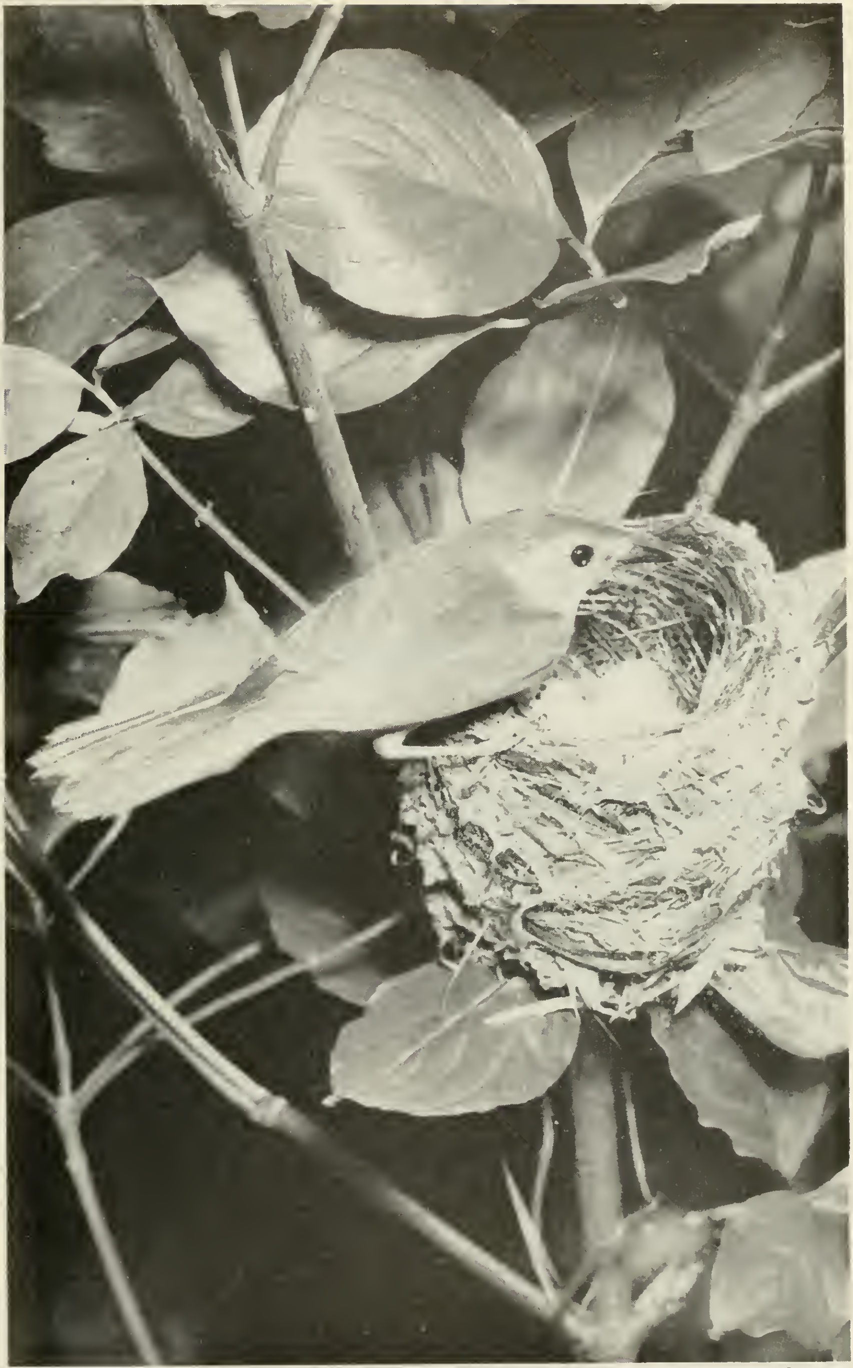
(Upper picture shows side of nest)



HOODED WARBLER, MALE, WITH YOUNG

Armstrong County, Pa., June 8, 1942

H. H. Harrison



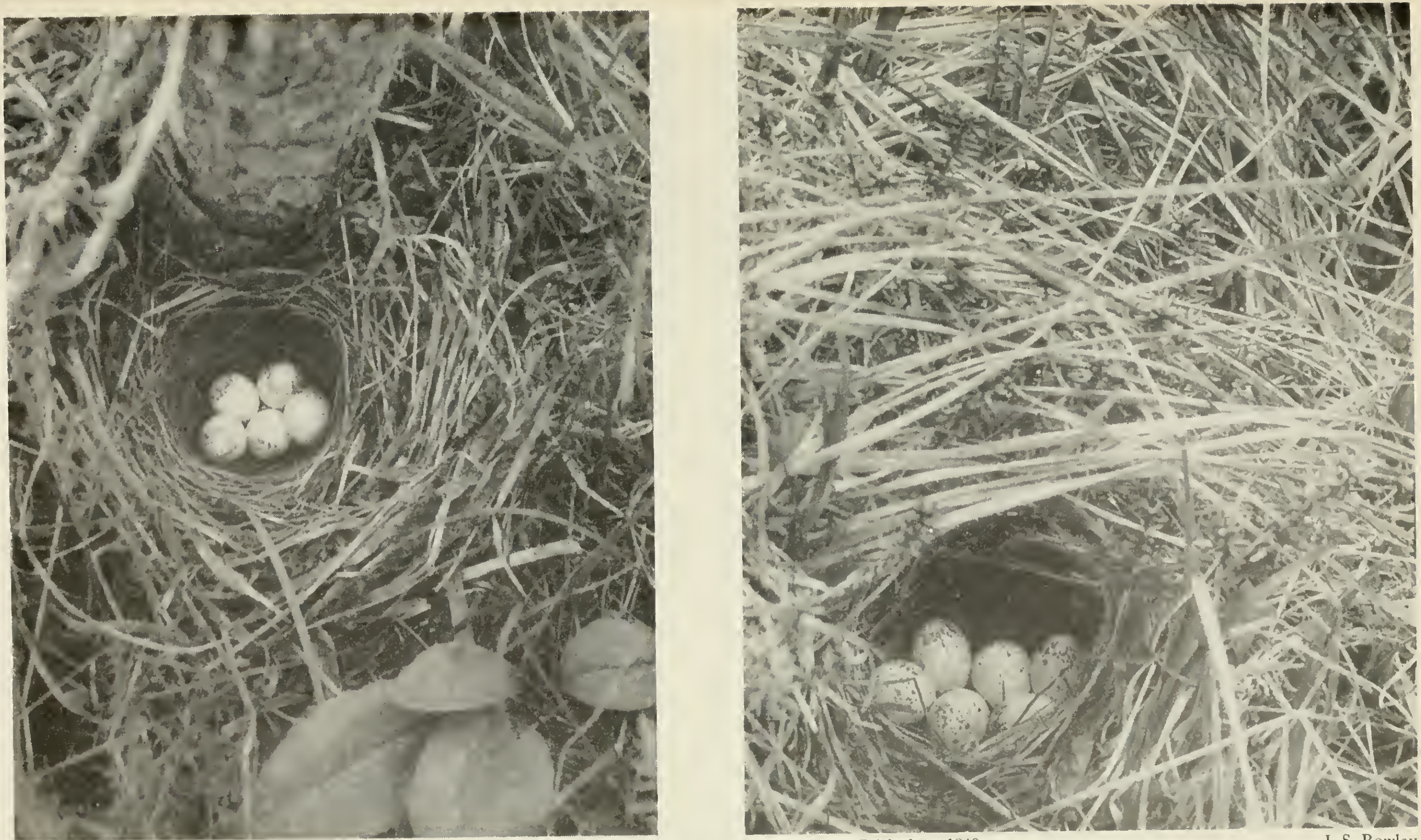
Morristown, N. J.

R. T. Peterson

HOODED WARBLER, FEMALE

Tabusintac, New Brunswick B. S. Bowdish

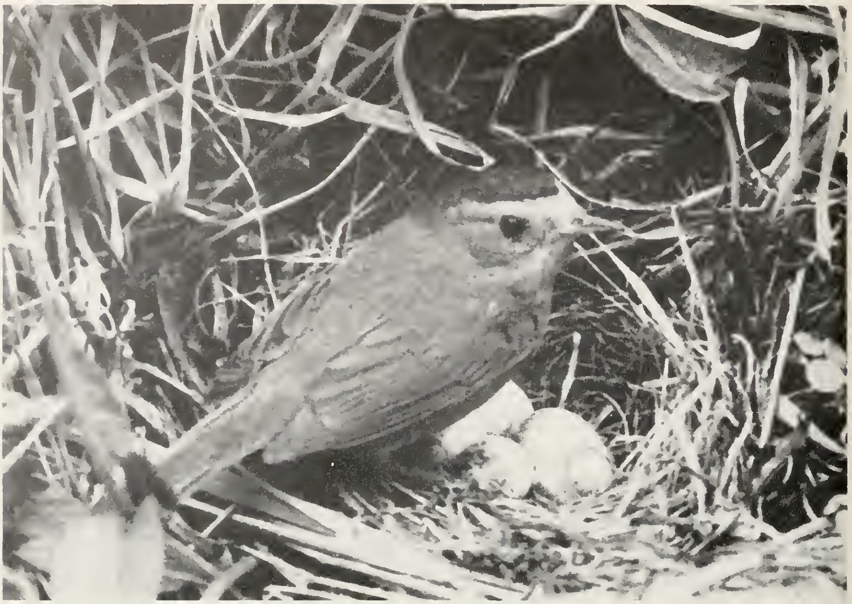
NESTS OF WILSON'S PILEOLATED WARBLER



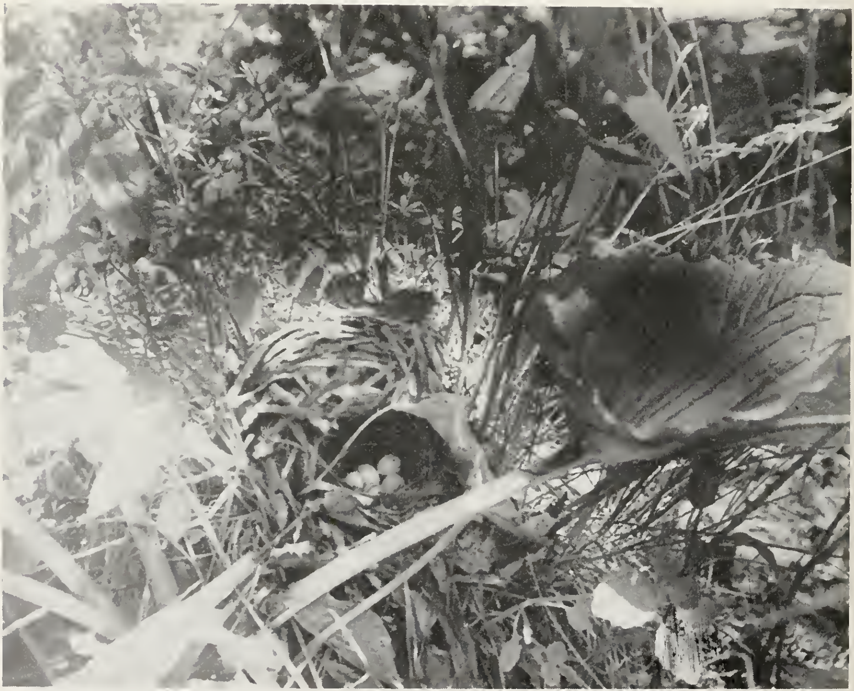
Askinuk Mountains, Alaska, June 17, 1924 Herbert Brandt

Mono County, Calif., June 1940 J. S Rowley

NESTS OF NORTHERN PILEOLATED WARBLER (LEFT) AND GOLDEN PILEOLATED WARBLER (RIGHT)

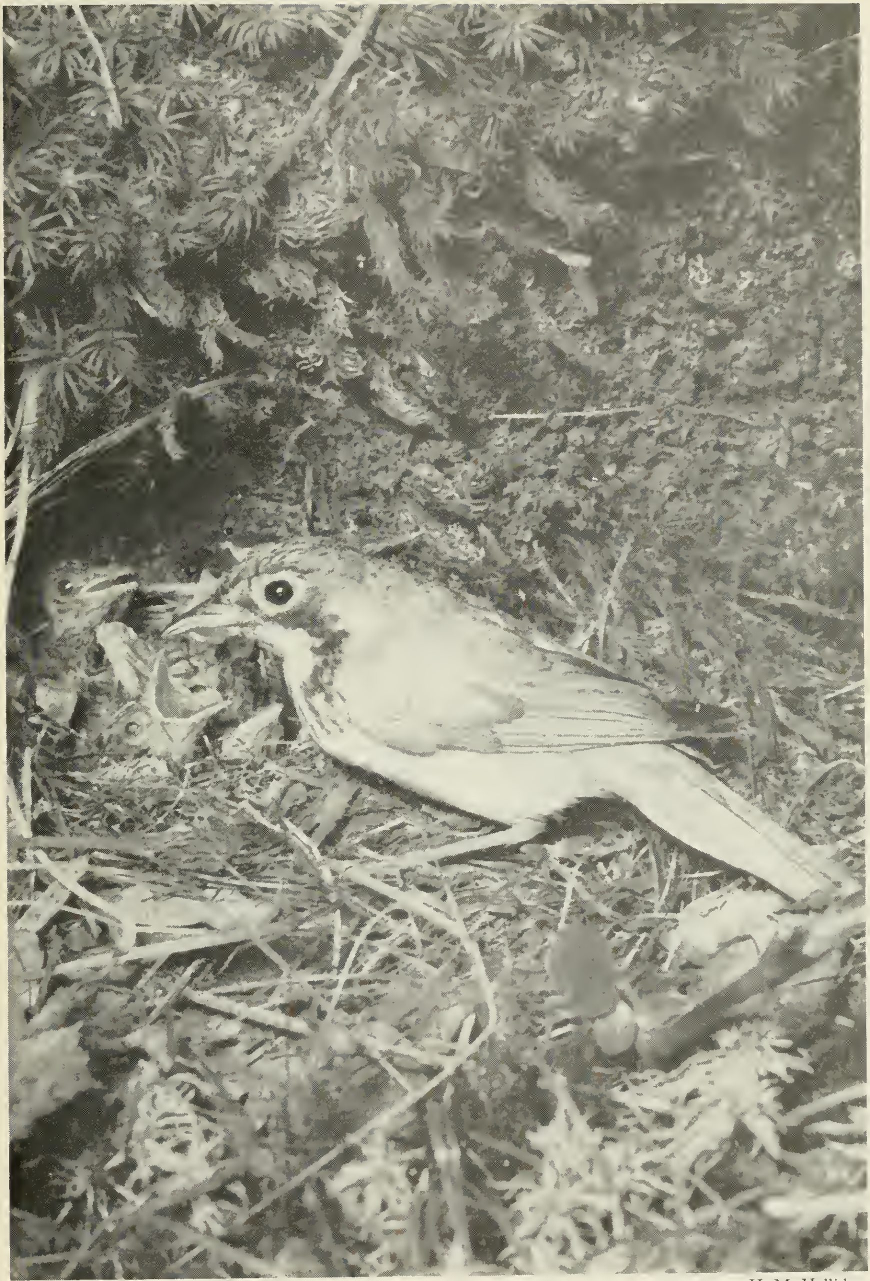


A. M. Bailey and R. J. Niedrach (Courtesy Colorado Museum of Natural History)



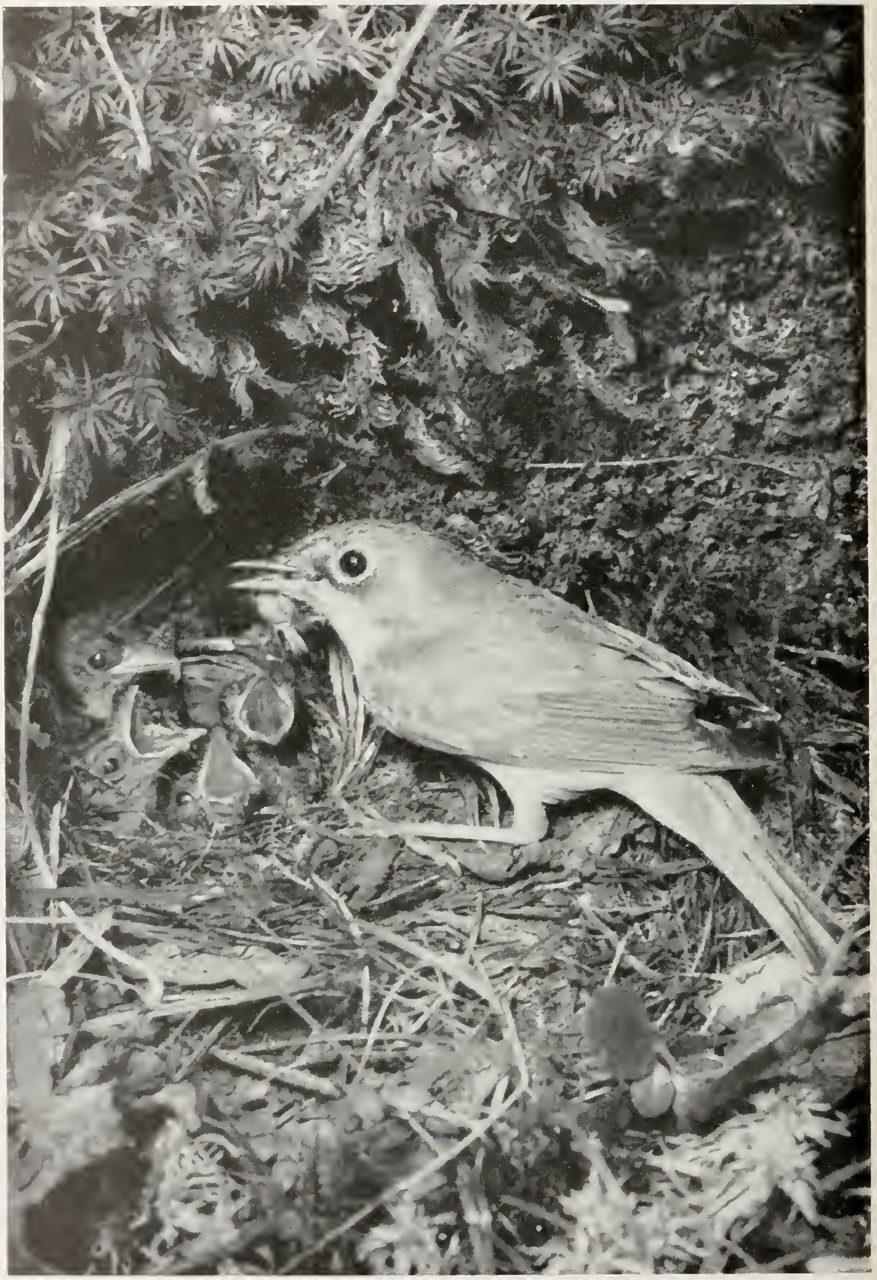
Yates County, N. Y., June 6, 1910 Verdi Burtch

GOLDEN PILEOLATED WARBLER (UPPER) AND NEST OF CANADA WARBLER (LOWER)



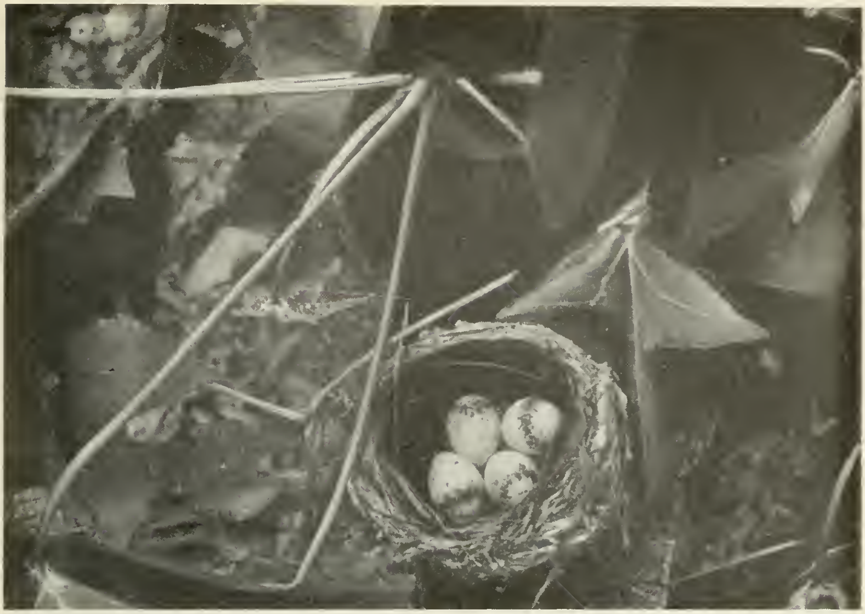
Sand Lake, Ontario, June 24, 1945 H. M. Halliday

CANADA WARBLER, MALE

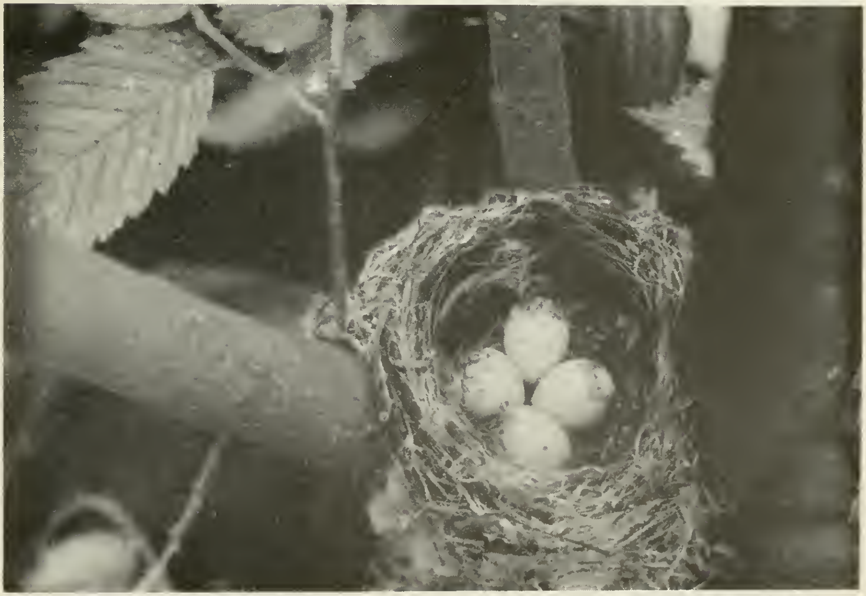


Sand Lake, Ontario, June 24, 1945 H. M. Halliday

CANADA WARBLER, FEMALE

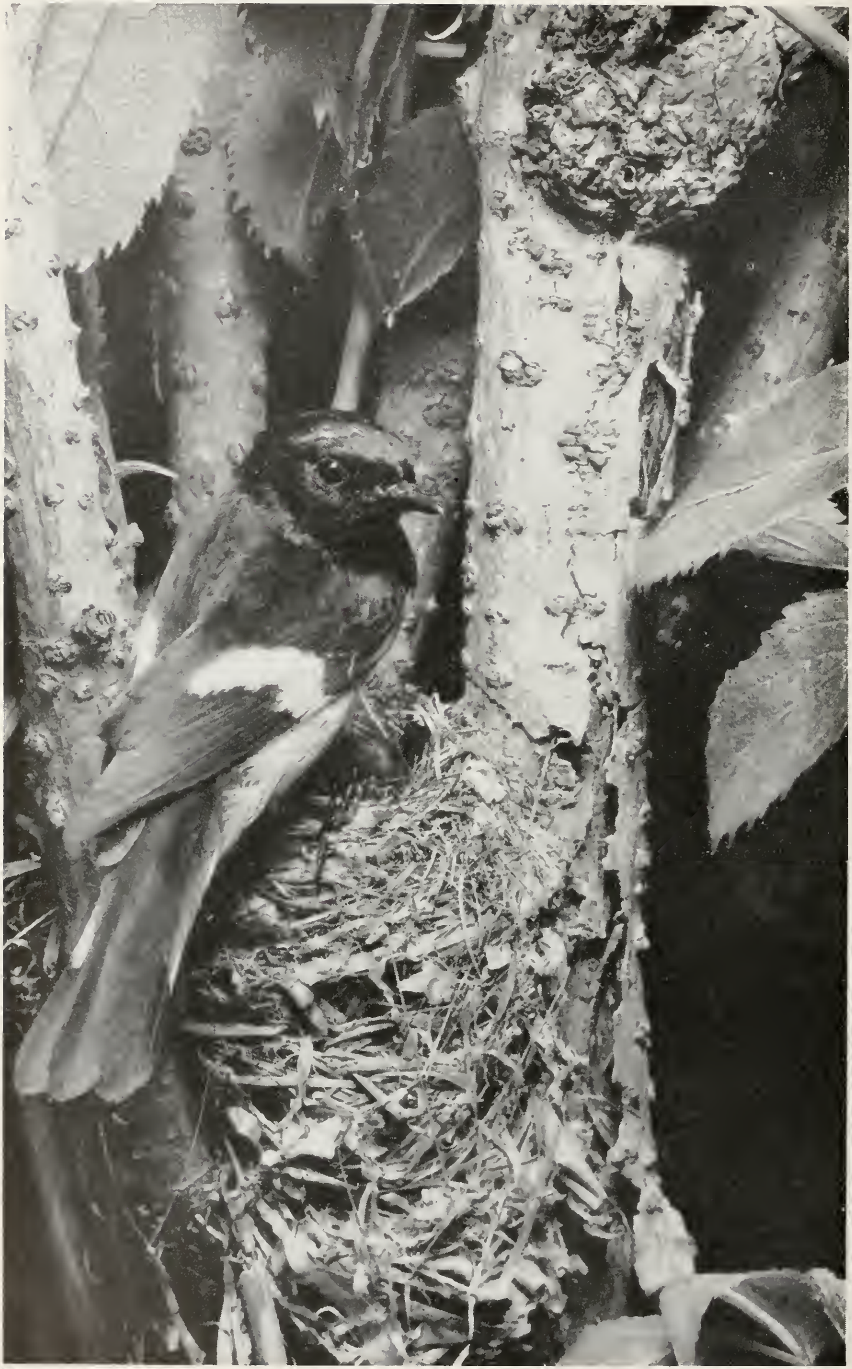


Washington County, Tenn. B. P. Tyler



Genesee County, N. Y., June 7, 1927 S. A. Grimes

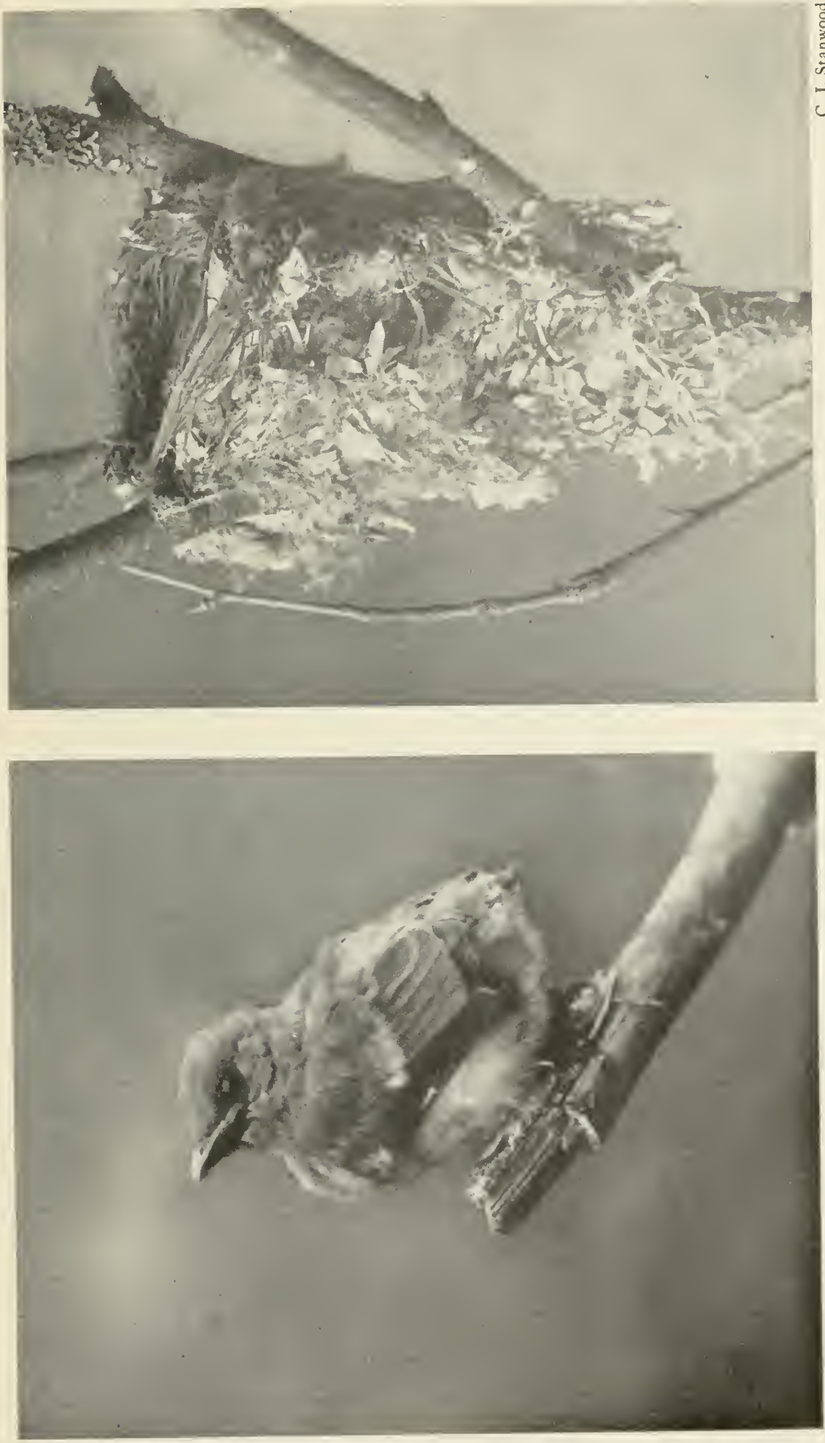
NESTS OF SOUTHERN AMERICAN REDSTART



Maine, June 1945

Eliot Porter

SOUTHERN AMERICAN REDSTART, MALE



Maine C. J. Stanwood

SOUTHERN AMERICAN REDSTART. FLEDGLING AND TYPICAL NEST

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